DRAGON USER

February 1988

The independent Dragon magazine

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Editorial

HAPPY NEW YEAR. I've been waiting for weeks to say that. To you, it may be late January, cold, wet and miserable, but to us it's the 4th of January, cold, wet, etc. Scot Press, most of British industry and the Post Office (nine days for Gordon Lee's copy to reach us, first class) stop for Christmas and the New Year, but not the Dragon.

John Penn Software has been in touch to announce a Dragon and Tandy show next April at Cardiff Wales Airport. The Penns are looking for demonstrators as well as retailers. See page 21 for further details. I was only mildly disappointed to discover that what I thought was Purple Car Painting was, in fact, Ample Car Parking, but perhaps Mr. Makin can arrange something . . .

Requests for hardware projects are being met with a vengeance this month with a blockbusting experimental interface project. Although the article is long, the individual sections are in reality quite simple and described in detail, so all would-be hardware enthusiasts can have a go.

Many thanks from everybody at and around *Dragon User* to our subscribers and advertisers, who are the real reason the Dragon keeps going. Here's to another year . . .

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How to submit articles

The quality of the material we can publish in *Dragon User* each month will, to a very great extent depend on the quality of the discoveries that you can make with your Dragon. The Dragon computer was launched on to the market with a powerful version of Basic, but with very poor documentation.

Articles which are submitted to *Dragon User* for publication should not be more than 3000 words long. All submissions should be typed. Please leave wide margins and a double space between each line. Programs should, whenever possible, be computer printed on plain white paper and be accompanied by a tape of the program.

We cannot guarantee to return every submitted article or program, so please keep a copy. If you want to have your program returned you must include a stamped addressed envelope.

Letters

This is your chance to air your views — send your tips, compliments and complaints to Letters Page, *Dragon User*, 12-13 Little Newport Street, London WC2H 7PP.

Not for killing

IN answer to Mike Hides's letter (December 1987) regarding the problem of quick disc filling, I have used the disc version of *Telewriter* since 1985 with a Dragon 64 and DragonDOS, and I came across the same problem.

I found that the problem arose only after I had used the kill command in the *Teledisk* program, so the fault must be there and not with *Telewriter*, and if the use of KILL within the program is avoided you can get more files on the disc. I usually average about 50 files alongside *Telewriter* and *Teledisk* on a single sided disc.

Another problem I find with the Dragon 64, but not a '32 is that if you wish to stop printing a file you have to turn off the printer as the print window on the '64 seems to be different to the '32. Other than these, I have had no trouble with *Telewriter* and feel that it is an excellent word processor and hope the hints given here are of use to other users.

Robert Haigh
Gledholt Villas
63 Gledholt Bank
Gledholt
Huddersfield

Black and white case

THANK you for printing my screen dump in the November issue of *Dragon User*. I am afraid to say that I left out one important piece of information, ie that the pens in the printer have to be rearranged so that they are in the order green, black, blue nd red. Without this, users will get some very odd looking screen dumps.

Now for some information for fellow CoCo users: I don't know if you've noticed, but Tandy seem to have given up on the CoCo in favour of such trashy computers as the Spectrum (spit). As a matter of fact, my two nearby Tandy shops have about two CoCo games, and about fifty Spectrum and Amstrad games. I have been unable to get any answer from Tandy about this even though I live near the UK headquarters. It seems the CoCo is going down the same road as the Dragon.

Finally, I have a complaint. Since going subscription, the quality of the printing in *Dragon User* has deteriorated, along with the spelling. The December column of *Adventure Trail* is full of spelling mistakes. I hope this is only a passing phase, as it detacts from the enjoyment of the magazine.

P.R. Marlow
50 Lime Avenue
Bentley
Walsall
W. Midlands
WS2 0JP

THANKS, PJ. This is the jolliest letter I've received all week apart from my gas bill. Perhaps if we can get the black and white right we can graduate to getting our colour scrambled, what d'you say?

Those aren't spelling mistakes, they are typos. Adventure Trail must have slipped the net in December. Please accept our apologies. I must disagree about the print quality; apart from wealthy magazines with large circulations, *Dragon User* has one of the best print standards about.

We are hoping to get more news on the progress of the CoCo, and in particular the CoCo Three in due course.

Every month we will be shelling out a game or two, courtesy of Microdeal, to the reader/s who send the most interesting or entertaining letters. So send us your hints and your opinions, send us your hi-scores and suggestions. Send us your best Dragon stories. What d'you think we are, mind readers?!

Dragon maths are the right answer

THANK you for the reply to my letter concerning the non-arrival of a recent *Dragon User*. I hadn't actually expected replies to the points raised, which were mainly inserted to fill up the page in the manner of casting bread upon the waters in the pious expectation that it would get all wet, and sink!

Your point is taken about publishing lists of suppliers, and is one of the main reasons that I was so concerned about the missing DU. The point I was trying to make is that the shows are *not* likely to come to Ireland, and those of us in the wilderness rely on *Dragon User* as the only link to what is happening. To put it another way, you and the rest of the staff and contributors of DU are probably the only reason that the Dragon continues to exist as a viable computer. Since three years of consistently trying to have the school's Dragons replaced by a Nimbus network have consistently failed, the Dragons have to soldier on even though they are becoming more and more difficult to maintain; for example, Peaksoft's joysticks are out of production, as I found when I tried to purchase them.

The kids are hard on joysticks, but when pupils in an 'inner-city' school badger their teacher to be allowed to come back after school to play computer games, I must be doing something right. In case you don't find that surprising, I enclose screen dumps from two of the 'games' — they are standard 'joystick to right answer' type — in MATHS!

Keep up the good work.

Denis J. McCarthy,
4 Summerville Terrace,
Dalkey, Co. Dublin, Ireland

MAGAZINES and special interest groups are rarely the only reason why something continues to exist, but they frequently provide a support system outside people's personal circle of friends and acquaintances and prejudices, even though the benefits may seem elusive at the time when it is not providing exactly what the consumer wants.

Any large group united by an interest is split by numerous factions with different angles. I recently saw a survey on what improvements Dragon User readers want from the magazine which was split very evenly between the three headings 'more OS-9/comms/Flex', 'more Basic' and 'less rubbish'. The even split is far more significant than the headings, because every month I get letters praising DU's articles on those and other subjects, and every month I get letters dismissing the identical subjects as 'rubbish'.*

If a computer needs 'usefulness' to justify its existance, then getting youngsters interested in maths should ensure the Dragon spiritual if not physical immortality.

Dragon's Roar*, **December 1987, Ed. Simon Jones.

Disc bug trap

I am writing in response to the letter from Mike Hides. The problem described is not a fault in *Telewriter* but one of at least 15 bugs in SuperDOS E6. While I would like to say the only cure is to get a copy of DOSplus, the problem can be overcome by inserting the line

```
570 CLOSE
```

in the program TELEDISK.BAS.

Philip G. Scott
4 Badgerwood Drive
Frimley
Camberley
Surrey
GU16 5UF

Neophite whizzard

I SEE the cry is on again for more machine code. We are not all whizz kids, please keep DU as it is, with something for everyone.

Only yesterday my son received a letter from one of his friends, asking where he can get a Dragon, as he has had four, yes, four Commodore 64s, which have had to be returned as they would not work properly!

So there is always someone out there likely to start from scratch.

Could anyone in Essex who has a spare Dragon, please contact my son's friend, Emile Wilson, Upper Mead, Boyles Court, Dark Lane, Gt. Warley, Brentwood, Essex CM14 5LL?

R J Rolph,
254 Grasmere Way,
Linslade, Leighton Buzzard,
Beds LU7 7QB

A happy story, which we hope will have a happy ending, and also a living, breathing example of points above. Why should the fact that some people want to do machine code mean that they are whizz-kids? You do not need genius to understand machine code, just a good guide, and practice.

Emile may find he likes machine code, but if he wants to stick with shooting space invaders, I for one wish him all the best. Groups of people need a certain critical mass to provide resources which benefit them all, and if they retreat into a closed outlook that mass evaporates. Despite his anxious words, Mr. Rolph seems like a good example of someone who doesn't mind sharing his Dragon world.

Projects please

I would like to add my name to the list of readers who are interested in hardware projects. I am sure that there is a lot that we can do to upgrade our Dragons. There must be people out there who produced lots of interesting add ons, unlike myself who, given a soldering iron, can fry chips in five seconds flat.

Perhaps somebody could astound Paul Harrison (December 1987, *64 Columns*) and work out how to connect up a 6845 VDU chip — it's only £9 from Maplin.

Most important of all, we must keep sharing our Dragon knowledge. See if we can put more fire into our Dragons in '88.

Alan Miller
6 Calder Gardens
Linslade
Leighton Buzzard
Beds LU7 7XE

If people ask for hardware long enough, we give them hardware. See page 14. This is not exactly an upgrade, but it is interesting.

A is for Edit

I WOULD like to point out that if while using EDIT mode you accidentally delete the line then you can restart EDITing from scratch by pressing 'A' (not while in insert mode).

James Bonfield
7 Water End
Wrestlingworth
Sandy
Beds SG19 2HA

Could be Norse

WE have just started a new Dragon magazine for all Scandinavian Dragon users. Write to use, and we will send you the first issue free. The magazine is written in Norwegian.

Dragon Bladet
c/o Geir Hovland
Legdavegen
6943 Naustdal
Norway

Late one September

IF November comes, can September be far behind?

Thank you for your letter, and it does appear that the Royal Mail is at fault over the September issue. November is safely delivered, but no September, alas.

I hope you are successful in your recall of duplicated deliveries and if you are, please remember me. Strangely enough, I had no problems in July.

ACT Wilson
50 Goodacre
Orton Goldhay
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PE2 0LZ

Obscure dream

I note that, as Pete Gerrard commented the month previously, you have found my writing difficult to decipher last month, as I note that my tip (*Dream saves faster*, Letters, December 1987) was mis-spelt in places. To give you the correction, I PRINT:

The start-of-symbol-table address is held at locations &H5FBA and &H5FBB. You printed the & as an S! (*Easily done, F.R. You wrote '&H5FBA' twice in this letter, instead of &H5FBB as the second location! Only a spot of razor-sharp detective work caught that in the nick of time. I hope Sherlock has it right this month. — Ed.*)

Also, to exit from Dream, one has to press BREAK then Q and *then* ENTER. You omitted the Q in the exit sequence. (*It was a quiet day. No Qs at the exit. Groan. Sorry.*) These two points may have left readers confused. Before reloading a Dream file which has been saved in this way, the CLEAR address must be set to the value at which it was when the file was saved. This is so that the interpreter allocates this space for Dream so that loading the new file will not overwrite the stack. For those who don't know, this is achieved by the command CLEAR N where N is the address of the highest memory you want BASIC to have access to, all higher RAM is reserved for Dream or whatever else (machine code, data, etc.).

Apologies for the lack of readability.

F.R. Ellahi
c/o 6 Clare Street
Halifax
West Yorkshire
HX1 2LF

THANK you for the prompt correction, F.R. One thing — what happened to the Word Processor? I hope your Dragon is not indisposed. My best wishes for its recovery if it is.

Words in reply

I WOULD like to reply to some of the points made in *Dragon User* November 1987 about my article *Three Little Words*.

To Mr. Grayson: OS-9 allows suppression of LFs when a CR is sent; Stylo should not inhibit this. Some printers do not allow CR without LF, DIP switches or no.

To Mr. Earnshaw: one of DragonDOS's few facilities is that it creates backup files — it is a shortcoming of the application that it does not support this.

I am unimpressed by references to 'some mainframe packages' which I see as an attempt to mystify. I'm sure *Telewriter* is better than some out of date mainframe packages, and how well do you think *Telewriter compares to Wordstar*, or one of the more modern PC wordprocessors?

To Mr. Rothery: OS-9 is ROM seemed like a good idea to Tandy, who use it with the CoCo3. You would lose nothing, since additinal commands would be on another input device. I can't imagine there would be no advantage in being able to power up in OS-9 rather than booting from disc. You yourself advocate the use of the RAM disc.

The point about the display is not what I prefer, but whether colour set, foreground/background are user-selectable.

I'm not impressed by an 80 column display that's in monochrome only, or a 'RAM disc' that offers a measly 64K and is not battery backed. But the price put me off from the start.

Telewriter right justify is undocumented — thank you for pointing it out.

The reference to MFREE? puzzles me in retrospect, too. If any non-OS-9 user is still unclear, Stylo reserves its own workspace automatically or as the user specifies.

64K of RAM is generally inadequate for smooth OS-9 operation, in my view. The time you save with multitasking is lost in the large number of disc accesses that are required.

Roger Merrick
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B23 5SH

Microdeal to leave the Dragon Market

MICRODEAL have now confirmed that they will be pulling out the the Dragon market as of 1st January 1988.

They stess that the decision is financial and owing to diminishing returns and lack of suitable product to publish.

Commenting on the lack of good new material, John Symes said: "This time last year we had fifty reasonable tapes to look at. This year, we only had ten. There just isn't the material about any more."

The remaining stock of Dragon software has been taken aboard by Computape. When asked if the list would be maintained, a representative of Computape said that for the present they would concentrate on selling from stock, but if the newer Microdeal games sold well enough, they would consider maintaining them.

Harry Massey of Computape recently told Dragon User that most of his business came from his company mailing list of about 5,000. Microdeal has confirmed that their Dragon mailing list is around 12,000. These figures are large enough to provide an active user base, but it is possible that the bulk of prospective customers have already bought all that they require from the present list, although Computape's low prices are bound to be attractive.

On the subject of the Dragon, John Symes said: "The Dragon has been an exceptionally good machine for us and I would like to take this opportunity to thank all our supporters in the past and hope that in the future when they retire from Dragon computing that they move onto one of the machines we now publish for, namely the Commodore Amiga and Atari ST.

"My thanks also go to all the staff at *Dragon User* who have kept this specialist journal and the Dragon market alive for much longer than expected."

Dragon User thanks John Symes for his kind words. But on behalf of many dedicated users, may we add the hope that, by the time the last of the Dragon users has retired, Microdeal will be publishing games for machines as yet undreamed-of.

Fourth Plus

PROGRAMMER P. D. Smith has completed a Forth compiler for the OS-9 operating system. Based on the Fig-Forth standard, the compiler includes extra commands from other systems to increase its power. It compiles into pure machine code, giving it a fast running speed.

As well as standard Forth commands it includes facilities for file handling allowing file handling without complicated block handling procedures. There is a 30-page manual which has a section detailing the operation of the compiler for advanced programmers.

The compiler is available from P D Smith at University Hall, Birchwood Road, Penyland, Cardiff CF2 5YB, price £14.95. The price includes software support and corrected updates if any bugs emerge.

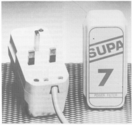
OS-9 User group is here

An introductory sheet for the OS-9 User Group has recently fallen into the hands of *Dragon User*. It has been warmly recommended by those who joined:

The group was set up to help Dragon OS-9 users in 1985, and has since expanded into additional hardware. it has a library with 46 volumes of public domain software, much of which is in BasicO9, Pascal and C, compatible at source level.

The group's bulletin is published on disc, called 'Newsdisk', allowing them to send software as well as news and advertisements. Members are supplied with a disc with which to correspond with the group.

The group is run on a non-profit basis, and membership is £10 per year. For further details contact the OS-9 User Group (European), 4 Roseberry Court, Llandudno, Gwynned LL30 1TF.



Power protection plug preferred

The SUPA 7 is a new power filter mains protection plug for computer equipment. Rated at 7 amps, the plug prevents voltage spikes from reaching equipment, and filters out radio frequency interference. Both these perils can be caused by electrical appliances switching, as well as by more abstruse causes such as CB radio and atmospheric disturbances.

The SUPA 7 can be used to protect word processors, electronic tills, telephone and telex systems, videos and burglar alarms as well as computers. The plug costs £14.95 plus VAT and 50p post and packing from Warwick Products, 50 Marsh Wall, West India Dock, London E14 9XJ. Tel. 01 538 2535.

Disc drive deal

HARRIS Micro Software are proud to introduce a new range of fast, modern high capacity dual and single switchable 40/80 track disc drives, complete with SuperDOS cartridge, for virtually the same price as their previous 40-track, single sided drives.

The drives, manufactured by Viglen, were originally designed for the BBC Micro, and have the advantage of connecting directly to SuperDOS or CumanaDOS cartridges without modification.

Prices for complete systems including cable, manual, cartridge and drive are £189.95 for the single 180 — 720K version, and £289.95 for the 360 — 1440K version. A deduction of £70 from the prices quoted covers the drive alone with cable.

Bob Harris can also supply a Viglen Dataduk signal splitter for joining two separate drives together if required. The cable decides the priority of the drives, avoiding the need for configuration at the computer, and allows the drives to be switched at will. The Dataduk costs £15.

Snip database cuts down paperwork

Title: *Diskbase*
Supplier: Pulser Software, 36 Foxhill, High Crompton, Shaw, Oldham OL2 7NQ
Price: £2.99 disc only

I CAN remember when my software collection comprised a handful of cassettes, which were left lying around by my old '32 and all I had to do was quickly glance through them to find the program I wanted. Now I have got three trays of cassettes and two boxes of discs and it used to take me hours to find a particular game or utility program.

Having typed up my cassette collection into several databases only to find that they were full before I had entered everything and then they used to print out one under the other wasting three quarters of my paper, I despaired of even starting to enter my entire disc collection.

Pulser Software have come up with the answer in *Diskbase*, written by Bill Tarrant. On Sunday morning I loaded in the Help Screen and then followed with the Menu. Starting with the Create screen I was prompted to input whether I was using one drive or two.

As I have two drives I was able to leave my blank disc in Drive 2 while I inserted my program discs into Drive 1. After 20 minutes the information was on the working disc for all my 56 dull discs. I then used the alphabetical sort, which took another 45 minutes. This may sound a long time but there were 647 different entries to be sorted, not including Menus, which are automatically left out by *Diskbase*.

During this time you can go away and do other jobs while the computer carries on with the 'shell sort'. When sorted, I printed out the full list which filled up three sheets of printer paper even though they were laid out over four columns. This has to be better than twelve sheets with most databases. Whenever I wish I can add to the database, and there are numerous options open to me. My printout is alphabetical with the name of the disc after it (you can use five characters including spaces to name your disc) but I would list out only Basic or only binary if I wished.

A search can be made for any letters in it, eg PAC would find SPACE WARS and PAC-MAN, or you can list what is on any particular disc. All listings can be made either to the screen or the printer. It took me 1 hour 10 minutes to enter everything into the database and print out an alphabetical listing. Other databases would need keying in, and I do not know another database for the Dragon that could handle 216000 entries (600 entries for each letter and each number).

At £2.99 this has got to be a real snip and I would advise all disc owners to purchase it. I would certainly not recommend piracy of it!!! Quite apart from the usual reason, you are told on-screen to use the original only, and there is a reason: illegal copying will lead to the loss of your copy. Do not worry: no problem is incurred when you use the copy you have bought, and anyway, the original is duplicated on the other side of the Flippy on which it comes.

This program has got to be worth five Dragons at this price.

Mike Stott

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A rolling stone gathers an Editor

Title: *Boulder Crash 2*
Supplier: Giant Soft, 18 Moorcroft Road, Sheffield 10 4GS
Price: £3.50

QUITE a while ago I bought *Boulder Crash* from Blaby Computer Games and soon afterwards won a copy of **Stone Raider 2** in a competition. These turned out to be virtually the same game, although myself and my two sons preferred the Blaby version. For those of you who do not know these games, the idea is to collect diamonds from around the screen of which you can only see a small part at any one time. When you have collected a set number you can then go through the Exit to the next screen. Boulders fall when you remove the earth under them, and these can crush you if you are not careful. On some screens you need to drop the boulders onto the Flappers who chase you to turn them into diamonds, although this does not work with the Ghosties. Beware also of the Slime which grows and tries to engulf you. Power is also available at certain places, and this can be fire — at pursuing creatures.

Boulder Crash 2 is a screen-editor for the original so you will need both programs before you can start designing your own screens. The instructions tell you to CLOADM the the 'kit' program from Side B and that this will then copy and compile the original taking about 15 minutes, but this is a 'once only' task. I cannot comment on the ease of the compiling as this review copy was already done for me. When the revised program is loaded, there are two extra options from the main menu. Pressing E takes you to the Screen Editor and X allows you to select infinite lives or any number from 1 to 100. Extra screens can also be loaded from Paul's tapes, and I will comment on these later.

When I first saw the Editing screen, I nearly gave up as the graphics are abysmal but forget about that, as once you go back to playing mode everything appears exactly the same as in *Boulder Crash*. I have tried several of these 'edit your own screen' ideas and I must admit that this is about the best I have seen, although it is not really my cup of tea. The instruction sheet that I received as very comprehensive, and it is possible to design your own screen and play on it within a very few minutes, but do not press reset if you are trapped somewhere, as you will lose everything, as I soon found out (I promise to read the instructions next time!)

Back to the extra screen provided with the program. On the whole they are very good, although several times my young seven-year-old has trapped himself between two walls and two boulders, and we have had to wait for the time to run out before we could start again due to not being able to reset. Still, I must admit that Paul Burgin's screens are certainly better than mine, which are either too easy or just plain impossible. Any screen you devise yourself can be saved out to tape so that you can play again whenever you wish, and there is also a built-in verify facility to ensure that they have been saved properly. The keys used in the edit mode are very logical. For instance, D is for diamond, W is for wall and SPACE is for a space.

To sum up, if you liked *Boulder Crash* and would like more screens or would like to design your own then I can recommend it. If you have not seen the original then contact R & AJ Preston and you could very soon be buying this one as well. If the price were under 2.50 I would give it four dragons, but as *Boulder Crash* is not new I will give it three.

Mike Stott

🐉🐉🐉

REBOOT

About the same time as we were publishing *Auto BOOT* last month, another short listing emerged from the pile to shed some light on the non-operational DragonDOS BOOT. Then a revision on that listing turned up. Then a revision of the original turned up . . . We aren't selfish, so we'll share them.

***Mike Hides** presents his solution to the BOOT dilemma*

THE command BOOT allows one program on a disc to be loaded and auto-run without the need to enter its name. Unfortunately, no method is provided in the DOS to enable users to make use of this facility. The following listing rectifies this, and allows one machine code program on a disc to be BOOTed. The listing works with Dragon-DOS and SuperDOS, but not with CumanaDOS.

To use the program enter it using an assembler (written using Alldream) and omit the line numbers. You need to enter the EXEC address of the program you intend to BOOT in line 1, and the file name in lines 33 and 35. Assemble the program and if free from errors, place a blank formatted disc in drive 1. BREAK X (in Alldream) will execute the assembled program and write it to your disc. Now copy the program you have decided to BOOT onto the same disc and all should now work.

If you wish to BOOT a Basic program try the following modifications:

a) delete lines 1 and 31

b) after line 30 insert the following three lines:

JSR 33823
JSR 33773
JMP 33951

c) make sure you changed the BIN to BAS in lines 35 and 35.

How it works

On entering the BOOT command the DOS loads sectors 3 to 18 of track 0 from the disc into memory starting at locations 9728. It then checks to see if the first two bytes contain the Ascii codes of 'OS', and if so execution is automatically started at 9730.

Listing one

```
1  EXADR  EQU   *EXEC ADDRESS
                *OF YOUR PROGRAM
2         ORG   9728
3  START  FCC   /OS/
4         JSR   $BA77
5         LDX   #$500
6         STX   $88
7         LDX   #TITLE-1
8         JSR   $90E5
9         LDX   #PROG
10        LDY   #$1DA
11 LOOP   LDA   ,X+
12        STA   ,Y+
13        CMPX  #PRGEND
14        BLS   LOOP
15        JMP   $1DA
16 PROG   LEAX  NEXT,PCR
17        STX   $168
18        LEAX  FNAME,PCR
19        LDA   ,X
20        STX   166
21        JMP   $D4CE
22 NEXT   LDX   #$D90B
23        STX   $168
24        LEAS  2,S
25        LDA   #$55
26        STA   $71
27        LDX   #$C706
28        STX   $72
29        LDX   #$00
30        STX   $FF48
31        JMP   EXADR
32 TITLE  FCC   /  BOOTING/
33        FCC   /FILENAME.BIN/,0
34 FNAME  FCC   34
35        FCC   /FILENAME.BIN/
36        FCC   34,0
37 PRGEND FCC   0
38 @START CLR   236
39        LDA   #3
40        STA   237
41        LDX   #9728
42 SAVE   PSHS  X
43        STX   238
44        JSR   49409
45        PULS  X
46        LEAX  256,X
47        INC   237
48        LDA   237
49        CMPA  #19
50        BLO   SAVE
51        JMP   33649
```

Lines 2 and 3 set the origin of the program to 9728 and put 'OS' into the first two bytes. Lines 4 to 8 do a CLS and put the title on the screen. The next part is to lower the program in memory so that it does not clash with the program it will be BOOTing. Lines 9 to 15 accomplish this movement. The filename is then moved into location 166 and LOADED using the routine at $D4CE (lines 16 to 21). Finally, lines 22 to 31 reset a Ram hook, ensure that the warm restart vector is correct, switch off the disc drive motors and jump to the execution address of your program.

The final part of the program (lines 38 to 51) writes all the above onto track 0 of the disc starting at sector 3. The label @START tells the assembler where to begin the execution of this part of the program.

Dummy run

The previous program which allowed the use of the BOOT command to LOAD and RUN one file on a disc codes has a potential problem: this is how to prevent the DOS writing over the code which resides on track 0, sector 3 of the disc. In the May 1987 issue Paul Dagleish gave details of how the directory track is organised, and using this information the code can be protected.

The method is to insert a dummy entry which occupies the appropriate part of the disc and cannot be deleted. After putting the BOOT code onto an empty disc, run the Basic program in **listing two**.

Paul Dagleish described how the directory track was arranged into slots 25 bytes long starting at sector 3 on tracks 16 and 20. This program writes directly to these tracks and sets up a file called leave ALO.NE! which appertains to occupy the appropriate position (track 0, sector 3).

Line 30 reads the disc directory track using the SREAD command and stores the current information in two string variables C$ and B$. Line 40 removes the information for the first directory slot from C$. Lines 50 to 110 read in the information for the dummy file from the DATA statements and a checksum is used to see if everything is OK. It is now vitally important that only the disc with the BOOT information is in drive one, otherwise, when the rest of the program is run directory will be irretrievably altered. Lines 120 to 150 give you the chance to abort. Finally the SWRITE command is used in lines 1280 and 190 to write the information onto the disc. Try DIR to see the result. This dummy file cannot be deleted by the normal DOS commands and should protect your BOOT code.

Listing two

```
10 CLEAR 400
20 A$ = "":B$ = "":C$="":CS = 0
30 SREAD1,20,3,C$,B$
40 C$ = MID$(C$,26)
50 FOR A = 1 TO 25
60 READ X$
70 A$ = A$ + CHR$(VAL("&H" + X$))
80 CS = CS + VAL("&H" + X$)
90 NEXT A
100 IF CS<>1203 THEN PRINT" DATA ERROR ":END
110 A$ = A$ + C$
120 CLS:PRINT" ARE YOU READY TO CONTINUE?"
130 PRINT:PRINT"ENTER Y or N"
140 Q$ = INKEY$:IF Q$ = "" THEN 140
150 IF Q$<>"Y" THEN END
160 PRINT:PRINT"PUT DISK WITH BOOT
    FILE IN","DRIVE 1 AND PRESS ANY
    KEY"
170 EXEC41194
180 SWRITE1,16,3,A$,B$
190 SWRITE1,20,3,A$,B$
200 DATA 02,6C,65,61,76,65,41,4C,4F
210 DATA 4E,45,21,00,02,01,00,00,00
220 DATA 00,00,00,00,00,00,FF
```

***Julian Osborne** has leapt, quite independently, to the same conclusion*

SINCE the publication of my article *Auto BOOT* on the BOOT command in the October 1987 issue of *Dragon User*, it has been noticed that under certain circumstances the BOOT routine causes problems where it occupies the first sectors of track 0 and can be over-written by the DOS saving a program onto these sectors — not an ideal situation!

To get around this problem, the following program 'de-allocates' the first 16 sectors of track 0 by altering the directory bit map to say that these sectors are occupied.

The procedure to set up a BOOT disc would then be:

1) DSKINIT a fresh disc
2) Run the program given in **listing three** (DIR should then show 171008 free bytes)
3) Run the BOOT program from last month's article. This should then create the BOOT code on track 0 as normal, but it will prevent DOS from using track 0 for any more programs. This routine works because SREAD and SWRITE do not refer to the directory contents when reading or writing to the disc.

The bit map for DragonDOS resides on track 20 sector 1 (for double sided 80=track drives it also takes up track 20 sector 2), and it represents the free space on a disc as follows:

Each of the bits in sector 1 or track 20 represents a disc sector, the first bit represents track 0 sector 0, the next bit represents track 0 sector 1 and so on.

If a bit is set to 1 then DragonDOS assumes the sector is free and if it is set to zero then it assumes that the sector is in use.

The RESERVE program reads the bit map into two strings (A$ and B$) and using the RIGHT$ function removes the first two bytes (set as 255 decimal which is 11111111 in binary). Then two 'null' bytes (0 decimal or 00000000 binary) are added to the front of the string and the string is then written back to the Directory track 20, and also to track 16 (the reserve directory track). The two 'null' bytes represent 16 bits which in turn represent the first 16 sectors of the disc (track 0, sectors 1 to 16) thus fooling DragonDOS into believing that they are occupied.

My apologies for not spotting this problem sooner but hopefully this program (and explanation) should solve it!

Anyway, as before I am willing to attempt to answer any queries about either the BOOT routine or the RESERVE program which may arise. My address is 8 Helston Road, Nailsea, Bristol BS19 2UA.

Listing three

```
10 REM RESERVE BOOT SECTORS ON DISK
20 REM RESERVES SECTORS 1 TO 16 ON TRACK 0
30 CLEAR 1000
40 SREAD 1,20,1,A$,B$ : REM READ BIT MAP SECTOR
50 C$=RIGHT$(A$,126) : REM CHOP OFF FIRST 2 BYTES
60 A$=CHR$(0)+CHR$(0)+C$ : REM REPLACE WITH 2 NULL BYTES
70 SWRITE 1,20,1,A$,B$ : REM WRITE BACK TO BIT MAP ON DIRECTORY TRACK
80 SWRITE 1,16,1,A$,B$ : REM WRITE BACK TO BACKUP DIRECTORY TRACK
90 CLOSE
100 DIR : REM SHOULD SHOW 171008 FREE BYTES REMAINING
```

BREAKing the '64

Martyn Armitage stops the 64's printer in its tracks

IN Pam D'Arcy's article *Epson Made Easy* in the February issue of *Dragon User*, she mentions the fact that the Dragon 64 will not allow the PRINTER routine to be interrupted by pressing the BREAK key as on the 32. She also says that the bug hasn't been mentioned to date. Well, unfortunately, the problem isn't a bug, but more of a case of poor forethought by the programmer. In the 32 ROM the BREAK key is checked for quite regularly, and if pressed a return to basic is the result. When the ROM for the 64 was written an extra routine was thrown in. This extra routine simply looks at the state of the keyboard, and if any key is pressed then the routine goes into a loop, waiting until the keyboard is clear, ie no key pressed. Pressing any key, including the BREAK key, will cause the machine to wait for the key to be released. Once the key is released then a check is made to see if the BREAK key has been pressed, and if it has then the usual return to Basic will ensue. Well then, why is it impossible to abort output to the printer? The answer is as said previoulsy, poor forethought. Between the 'wait while key pressed' routine and the 'check for BREAK' routine there are approximately 40 machine code instructions to be executed, at an average of four microprocessor cycles per instruction this gives a period of about 160 mpu cycles or approximately 180 microseconds (0.000180 seconds), not a lot of time to either release and re-press the BREAK key, or to hit the BREAK key at the right time. Too early and the wait routine is entered, too late and the BREAK check is missed.

The problem is very infuriating, as the only way out is to wait for the LLIST etc. to end naturally or press the RESET key. My answer to the problem is to put the computer into map 1 (all RAM) copying the ROM across and then to patch out the 'wait while key press' routine. The short machine code program that follows accomplishes this, and it also copies the CARTRIDGE memory (&HCOOO — &HEFFF) so that should a disc drive or cartridge be present then it can still be used as normal.

The machine code generated by the assembler listing sits in the first page of graphics if Dragon Dos is present, or the second graphics page if the Dos isn't present. The code is position independent and so can be relocated anywhere in memory if you should need to do so, for example if you have something in the graphics memory that you wish to preserve.

If you don't own an assembler (shame on you) then the basic listing will install the machine code, which will then require saving, the addresses being :

Start &HCOO
End &HC34
Exec &HCOO

Remember that when the Dragon 64 is in map type 1 (all RAM) pressing the reset button causes the machine to revert to map type 0 (RAM and ROM), and doing so will cause the patch to be inoperative. If you do happen to press the reset button while in map type 1, you can type POKE &HFFDF,1 ENTER>, which will put the Dragon into 64k RAM mode and the patch should be intact. If not then you will have to reload the program and execute it.

Listing one

```
                              ORG     $C00
                              PUT     $C00
0C00     3401                 PSHS    CC       SAVE CC REG.
0C02     1A50                 ORCC    #$50     DISABLE IRQ'S
0C04     B68000               LDA     $8000    FIRST ROM BYTE
0C07     3402                 PSHS    A        SAVE 'A
0C09     7A8000               DEC     $8000    ALTER FIRST ROM BYTE
0C0C     B68000               LDA     $8000    GET FIRST ROM BYTE
0C0F     A1E0                 CMPA    ,S+      COMPARE WITH OLD VAL
0C11     2612                 BNE     RAM      NOT SAME=MAP1 (RAM)
0C13     8E8000               LDX     #$8000   START OF ROM
0C16     B7FFDE   ROM         STA     $FFDE    SET MAP 0 (ROM)
0C19     A684                 LDA     ,X       GET ROM BYTE
0C1B     B7FFDF               STA     $FFDF    SET MAP 1 (RAM)
0C1E     A780                 STA     ,X+      STORE IN RAM, INC X
0C20     8CFF00               CMPX    #$FF00   LAST ROM BYTE?
0C23     26F1                 BNE     ROM      NO SO GET NEXT BYTE
0C25     867E     RAM         LDA     #$7E     OPCODE FOR JMP
0C27     B78000               STA     $8000    RESTORE RAM BYTE
```

Listing one cont.

```
0C2A    8EBCFD     LDX    #$BCFD    SEND TO PRINTER ADDR
0C2D    B7BECD     STA    $BECD     OPCODE FOR JMP
0C30    BFBECE     STX    $BECE     PATCH OUT WAIT CODE
0C33    3581       PULS   CC,PC     RESTORE IRQ'S RETURN
```

Listing two

```
10 CLS
20 FOR I=&HC00 TO &HC34
30 READ A$
40 A=VAL("&H"+A$)
50 POKE I,A:CS=CS+A
60 NEXT
70 IFCS<>6883 THEN PRINT "ERROR IN DATA":END
80 PRINT"CODE INSTALLED...":PRINT"REMEMBER TO SAVE IT"
90 DATA 34,1,1A,50,B6,80,0,34,2,7A,80,0
100 DATA B6,80,0,A1,E0,26,12,8E,80,0
110 DATA B7,FF,DE,A6,84,B7,FF,DF,A7,80
120 DATA 8C,FF,0,26,F1,86,7E,B7,80,0
130 DATA 8E,BC,FD,B7,BE,CD,BF,BE,CE
140 DATA 35,81
```

Winners and Losers

Every month Gordon Lee will look at some prize programming

THE competition was not in itself difficult, although many readers were tripped up by minor problems. To quote Phil Sapiro: "A very short program is all that is necessary. . .", and to prove the point **listing one** was what he attached. Paul Weedon worked along similar lines (**listing two**). By taking the digits in groups of five (still within the computer's mathematical capability) the running time was effectively reduced five-fold.

Almost without exception all of the winners adopted a version of these programs. However, this month, the non-winners also came up with a number of surprises. An identical 5231772315 from Randy Longshore and E A Newman: the explanation was simple! The programming and mathematics were perfectly correct, but they had both counted the number of digits from the decimal point end and not from the left. A technical knockout!

Surprises also from Dave Lardner and Denis O'Mulloy, who submitted 478799?625 and 5267797874 respectively. One is almost the reverse of the other. Closer examination reveals that the first five digits of Mr. Mulloy's number, reversed, is the same as the first five digits of Mr. Lardner's number, while the last five digits of Mr. Lardner's number is almost the same as the start of the answer. I suspect that the different digit is just a copying error and that both are five digits too soon in the sequence. Remember that though there are 34542 ones in the division, there are only 34537 digits in the result. This difference of five is due to *six* ones needing to be called before the first digit of the answer appears – that is, the division will begin: 111111/34543. The number of digits in the answer is always five short of the number of ones.

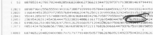
A good safeguard against this sort of error is to print out selected portions of the result. I have compiled the result into lines of 70 characters. The digits shown are from the beginning, middle and end of the full answer. To determine where to find a specific digit, divide the number of the digit by 70. The 20001st digit is located by:

20001/70 = 285 remainder 51

The required digit (which begins the sequence of our answer) is therefore found on line 285 at the 51st position.

Listing one

```
10 CLS:D=34543:Q=111111
20 FOR N=1 TO 20000:I=INT(Q/D):R=Q-D*I:Q=10*R+1:NEXT
30 FOR N=1 TO 10:I=INT(Q/D):R=Q-D*I:Q=10*R+1:PRINTI;:NEXT
```



```
[  0]  3216602817100747216834412503578470634024581278728280910231048580352
[  1]  672585215850132041545641985673251052633271896219526709061491796054
[  2]  8454422346383090962311064792020544860351188695571059581133981157140
[  3]  42382280378401155403731902588400286920971285386651741629595319199958
[  4]  499265006256292479260953336742932231946012538317781058712651220533993
[  5]  8878531427817824482850682080627366213447329737171383814697944912460
          :         :         :         :         :         :
[282]  8898796025565559190316738879399910578441684599227372003332400518516
[283]  1166404513537072955768494662047625021309993663292450311527982836207
[284]  9504128509715748809052806968448342967058770550071[illegible]7815508
[285]  236954263124543644475323831488611617726054804478777625310804247202
[286]  6998266251081582697250126251660571204328260750690765[illegible]97238546481
[287]  0851434765686567788296068989697221176826306664479376751038158559215
          :         :         :         :         :         :
[488]  6874652204820400981707179779148050577862696092149237504302206267872
[489]  4025160267235362044730078774602990797299340274762212636745827261995
[490]  0556729615583797328289700116119361697336974527722291379182789888287
[491]  1620910491593408537507197148803262921897666997976756828043630000611
[492]  5352491419711985383756799094204646704429583739429438992302669458677
[493]  910115250878936719772779177
```

Listing two

```
10 CLS
20 X=34543:Y=1111111
30 FOR I=1 TO 20010/5
40 Z=Y/X
50 Y=VAL(STR$(Y-(INT(Z)*X))+"11111")
60 IF I>20001/5 THEN PRINT INT(Z);
70 NEXT I
```

Pamcodes

*Part three of **Pam D'Arcy's** introduction to machine codes*

AS listings get longer, the chances of my incorrectly copy typing values from assembler listings increases the risk of errors, so although I was trying to keep listings non-specific, I am now supplying assembler listings with articles. Lines commencing with an asterisk and the 'Comments' following the semi-colons to the right of source code lines are my assembler's equivalent of Basic's REM statements — they are for the programmer's benefit only and are ignored when the machine code is generated by the assemble process.

Listing one

```
5001              * LISTING 1
5001
5001
5001              * JMPNOLFT (FILENAME)
5001              *
5001              * IGNORE LEFT ARROW KEYPRESS
5001              *
5001              * USING DREAM ASSEMBLER
5001              * AFTER CLEAR200,&H5000
5001
5001 BDBA77       GO     JSR   $BA77     ;CLS
5004 CC0500              LDD   #$500     ;PRINT@256
5007 DD88                STD   $88
5009
5009 BD8006       GETKEY JSR   $8006
500C 27FB                BEQ   GETKEY
500E 8108                CMPA  #$08      ;LEFTARROW
5010 27F7                BEQ   GETKEY    ;YES-IGNOR
5012 BD800C              JSR   $800C     ;NO-DISPLY
5015 810D                CMPA  #$0D      ;<ENTER>
5017 26F0                BNE   GETKEY    ;NO - CONT
5019 39                  RTS
501A
```

Listing one (JMPNOLFT) covers the first requirement of last month's workout and **listing two** (JMPCHK) the second requirement. As you can see, in both instances, the only amendment to the original PRINT@256 routine is the insertion of a few lines of comparison code between lines 30 and 40.

If you are struggling with references to ascii values for keypresses, there is a list of them in appendix A of the manual supplied with the Dragon. Capital letters are the decimal values)64. With the Editor still telling me to cut down on length, I shall not include further comment on the code but please, please do write in if there is something that you need to have explained further.

CoMPare does not alter the two items being compared. The result of the comparison causes various bits or flags of the condition code register (CCR) to be set (made=1) or unset (made=0) enabling different program paths to be followed depending on the result by using the conditional branch instructions.

So far, only BEQ and BNE have been used in examples depending on whether the value in the register being compared is EQual or Not Equal to a fixed value in the operand column of the source code. A slightly different case is where we immediately follow

GETKEY JSR $8006

with a BEQ instruction. The Jump to SubRoutine instruction itself does not affect the condition code register. This is a case where the ROM routine sets up two items of information (or return parameters) that we can use:

— the Ascii code of a keypress, if any, else null ($00) in register A

— the condition code register to reflect the contents of register A; that is, a BEQ will be obeyed if there was no keypress (Register A=zero=$00); a BNE will be obeyed if Register A does contain a keypress value.

As with IF statement in Basic, if the conditions are met, the instruction (ie branch) is carried out, otherwise the program path continues with the instruction following the unsatisfied conditional branch instruction.

Plus or minus

Signed and unsigned conditional branch instructions were mentioned last month. Having just written a piece on it, it was made to look very complicated and I realise that I was not supporting it with an example anyway as I want to make a start on adapting position dependent code to run on your own systems. I am therefore holding it in abeyance for an appropriate time.

Adapting code

A quick glance through the four Dragon machine code (as opposed to general 6809) books that I have show that most use position dependent rather than relocatable (or position independent) code in examples. The instant give away is if one sees JSR and JMP rather than BSR and branch instructions, excepting JSR/JMP to Basic ROM routines which are, in our programs, a special and (unless you are interested in running in Dragon 64 mode) acceptable case.

The item that particularly caught my eye for our first example is *The Yellow Blob* from Jones and Cowsill's *Dragon Machine Code* (Shiva Publishing Ltd), but first consider the very simple examples of **listings three to five**.

In **listing three** (JSRFRED), JSR (Jump to SubRoutine) generates the extended mode of instruction = an actual, fixed address, at addresses $5000 and $5009 respectively for FRED and HARRY. Thus, barring strokes of pure luck where locations $5008 and $5009 just happened to contain $39 at the time, the program will only execute correctly if always loaded at its assemble address of $5001. If, for example, it was a machine code subroutine that we wished to call from a large Basic program, the memory $5001+ would probably be occupied by Basic program and the machine code subroutine would need to be loaded and executed beyond the end of the Basic and its variables space, probably around the $7000 area. If the program was loaded at, say, $7001 using a load offset of $2000 (CLOADM"JSR-FRED",&H2000), the program still jump to addresses $5008 and $5009 to execute subroutines FRED and HARRY, rather than a few bytes beyond the start of the program.

There are two ways of tackling such machine code. Even though one cannot sometimes assemble code directly in the area that one wants the machine code to operate from (for instance, depending on which version is being used, the Dream

Listing two

```
5001              * LISTING 2
5001              *
5001              * JMPCHK (FILENAME)
5001              *
5001              * ERASE USING LEFT ARROW BUT DO
5001              * NOT ERASE PRE-START OF INPUT
5001              *
5001              * USING DREAM ASSEMBLER
5001              * AFTER CLEAR200,&H5000
5001
5001 BDBA77       GO     JSR   $BA77     ;CLS
5004 CC0500              LDD   #$500     ;PRINT@256
5007 DD88                STD   $88
5009
5009 BD8006       GETKEY JSR   $8006
500C 27FB                BEQ   GETKEY
500E 8108                CMPA  #$08      ;LEFTARROW
5010 2607                BNE   DISKEY    ;NO-DISPLY
5012 9E88                LDX   $88       ;CURR.CURS
5014 8C0500              CMPX  #$0500    ;POS.@256
5017 27F0                BEQ   GETKEY    ;YES-IGNOR
5019
5019 BD800C       DISKEY JSR   $800C     ;DISPLAY
501C 810D                CMPA  #$0D      ;<ENTER>
501E 26E9                BNE   GETKEY
5020 39                  RTS
5021
```

Listing three

```
5ØØ1                  * LISTING 3
5ØØ1                  *
5ØØ1                  * JSRFRED (FILENAME)
5ØØ1                  *
5ØØ1                  * EXAMPLE OF POSITION DEPENDENT
5ØØ1                  * MACHINE CODE
5ØØ1                  *
5ØØ1                  * USING DREAM ASSEMBLER
5ØØ1                  * AFTER CLEAR2ØØ,&H5ØØØ
5ØØ1
5ØØ1
5ØØ1 BD5ØØ8           GO      JSR    FRED
5ØØ4 BD5ØØ9                   JSR    HARRY
5ØØ7 39                       RTS
5ØØ8
5ØØ8 39               FRED    RTS
5ØØ9
5ØØ9 39               HARRY   RTS
5ØØA
```

Listing four

```
5ØØ1                  * LISTING 4
5ØØ1                  *
5ØØ1                  * JSRFRED2 (FILENAME)
5ØØ1                  *
5ØØ1                  * EXAMPLE OF POSITION DEPENDENT
5ØØ1                  * MACHINE CODE
5ØØ1                  *
5ØØ1                  * USING DREAM ASSEMBLER
5ØØ1                  * AFTER CLEAR2ØØ,&H5ØØØ
5ØØ1
5ØØ1
7ØØØ  7ØØØ                    ORG    $7ØØØ
7ØØØ                          PUT    $5ØØ1
7ØØØ
7ØØØ BD7ØØ7           GO      JSR    FRED
7ØØ3 BD7ØØ8                   JSR    HARRY
7ØØ6 39                       RTS
7ØØ7
7ØØ7 39               FRED    RTS
7ØØ8
7ØØ8 39               HARRY   RTS
7ØØ9
```

assembler itself occupies $5E00+ in memory), the assembler may contain the option to generate code as if it were in the required area. Using Dream, this can be achieved using the DRG (=ORiGin) and PUT directives. **Listing four** says generate code as if it is positioned at $7000 (ORG) but for the assemble, place it in its normal workspace ($5001). If the PUT had been omitted, the generated code would be placed directly into address $7000+ corrupting the Dream program with indeterminate, but no doubt catastrophic, results. ORG and PUT are what are known as assembler DIRECTIVES. They are not machine code instructions, but the assembler's own means of allowing programmers to give it command and this is one of the areas of greatest difference in assemblers.

Having assembled the code in listing 4, that code is now fixed to execute successfully only from address $7000 in the machine. Just before I leave that, as this may well be an area that newer machine coders may have difficulty understanding with their assemblers, a word on saving machine code assembled in a different place from where it will run (at least, for Dream assemblers, but perhaps it is also appropriate to other assemblers).

After assembly, the generated code is actually sitting at address $5001+ in the machine. Its length is $7000-$7008 inclusive (first and last byte generated in the listing) = 9 bytes. It then needs to be saved with the likes of

CSAVEM"JSRFRED2",&H5001,&H5009,
&H5001

but will only execute successfully if reloaded using an offset to take its start address to $7000 ($7000-$5001= $IFFF). Once reloaded at address $7000 (CLOADM"JSRFRED2",&HIFFF), it can be further saved from that position in memory to avoid having to use offset for future loads, eg

CSAVEM"FRED7000",&H7000,&H7008,
&H7000

If your assembler contains facilities to ORG/PUT generated code, this technique can be applied to any source code coded to occupy an area not able to be assembled directly into because of your assembler occupying that area.

This, however, is not necessarily the best solution to such position dependent code as there may be very good reasons for wishing to change its load position another time. One can amend the source and reassemble for a new load position but a much better solution would be to get rid of its position dependency altogether. The above is obviously a very simple example, but by replacing extended mode JSR and JuMP instructions with relative branch instructions, such instructions instantly become position independent, or relocatable. **Listing five** (BSRFRED) replaces JSR instructions with BSR (Branch to SubRoutine) and the code generated is such that wherever the routine is loaded (barring corrupting Basic or DOS workspace!), it will function correctly.

Listing five

```
5ØØ1                  * LISTING 5
5ØØ1                  *
5ØØ1                  * BSRFRED (FILENAME)
5ØØ1                  *
5ØØ1                  * EXAMPLE OF POSITION DEPENDENT
5ØØ1                  * MACHINE CODE
5ØØ1                  *
5ØØ1                  * USING DREAM ASSEMBLER
5ØØ1                  * AFTER CLEAR2ØØ,&H5ØØØ
5ØØ1
5ØØ1
5ØØ1 8DØ3             GO      BSR    FRED
5ØØ3 8DØ2                     BSR    HARRY
5ØØ5 39                       RTS
5ØØ6
5ØØ6 39               FRED    RTS
5ØØ7
5ØØ7 39               HARRY   RTS
5ØØ8
```

The yellow blob

Jones and Cowsill's *Dragon Machine Code* looked interesting enough from a quick perusal in a bookshop for me to add it to my collection. However, the more I look at the example that I have selected, the more I wonder how beginners to machine code may have coped with the sections before the book moves on to providing actual assembler listings. If you have struggled with trying to use the early listings as actual assembler source, the following should help throw light onto ways of amending it to make it produce the required object code and hence more understanding of the text. For those who have not got the book, working through the example may help you understand some of the things to look for in listings that you are experiencing similar difficulties with.

The program as it appears in the book (**listing six** — YELLBLOB) first caught my eye because of the use of JSR rather than BSR statements. However, further examination yields even more valuable fodder for us to consider in trying to get other people's code to run on our systems.

The intention of the program is to be able to move a yellow blob around the text screen using the arrow keys. Pressing the break key terminates the program. I particularly like the way that this initial listing doesn't actualy include the code for the movement (subroutines UP, MDOWN, MLFT and MRGHT consist of an RTS). I often construct programs on this basis, even in Basic, to test that the skeleton works before putting on the flesh.

Monthly workout

Having said that the despite my intentions of not leaving you dangling mid-sentence, as it were, from month to month, I fear that my time is up. I will leave you, then, with the listing to ponder and perhaps see if YOU can get it going on your system. The program starts off by clearing the text screen ('poking' code # $60 to the text screen area ($400-$5FF) is the equivalent of writing ascii space characters to it using JSR $800C). The # $9F value is the text screen's yellow blob — see graphics

Listing six

```
*
* YELLBLOB (FILENAME)
*
* THE YELLOW BLOB - PAGE 56
* FROM "DRAGON MACHINE CODE"
* BY JONES&COWSILL (SHIVA)
*
* TYPED IN AS PER THEIR LISTING

6404    LDX   #0400   ;BE 04 00
        STX   6400    ;BF 64 00
        LDY   #01FF   ;10 BE 01 FF
        LDA   #60     ;86 60
        CLR   6402    ;7F 64 02
        CLR   6403    ;7F 64 03
CLEAR   STA   ,X+     ;A7 80
        LEAY  -1,Y    ;31 3F
        BNE   CLEAR   ;26 FA
        LDA   #9F     ;86 9F
        LDX   6400    ;BE 64 00
        STA   ,X      ;A7 84
KBD     JSR   8006    ;BD 80 06
        BEQ   KBD     ;27 EB
        CMPA  #5E     ;81 5E
        BNE   DOWN    ;26 05
        JSR   UP      ;BD 64 53
        BRA   KBD     ;20 F2
DOWN    CMPA  #0A     ;81 0A
        BNE   LEFT    ;26 05
        JSR   MDOWN   ;BD 64 54
        BRA   KBD     ;20 E9
LEFT    CMPA  #08     ;81 08
        BNE   RIGHT   ;26 05
        JSR   MLFT    ;BD 64 55
        BRA   KBD     ;20 E0
RIGHT   CMPA  #09     ;81 09
        BNE   BREAK   ;26 05
        JSR   MRGHT   ;BD 64 56
        BRA   KBD     ;20 D7
BREAK   CMPA  #03     ;81 03
        BEQ   END     ;27 02
        BRA   KBD     ;20 D1
END     RTS           ;39
UP      RTS           ;39
MDOWN   RTS           ;39
MLFT    RTS           ;39
MRGHT   RTS           ;39
```

characters page of the Dragon manual, Appendix A — and we should be familiar with the 'get keypress' ROM call (JSR $8006) by now!

The working visual result is not very exciting — green screen with yellow blob top left and the program simply sitting there until break is pressed — but the prospect of what you have achieved if you have used this listing (and not your own routine), particularly if your assembler is not geared to letting you generate code at $6400, should be very exciting indeed to you (in which case, you are probably beyond needing this series at all!). The only other thing that I will say is that if your assembler is like mine, you will need to add in an awful lot of dollar signs to get it to generate code as this listing suggests (shown as comments in the source lines). Good luck!

Crossword

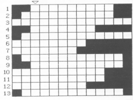
The third month of the Dragon Crossword. We have the results from the first crossword now, and the lucky winners whose correct entries were plucked from the editor's hat were Paul Simpson, who wanted an up to date *Total Eclipse*, which is now available from John Penn Software, and Mrs. H. Clarke, who gave us a list of choices, most of'em deletions! We will see what we can do — no promises.

There will be a couple of free tapes from the Editor's Magic Bottomless Box for the first correct entries to reach us each month. You can even try telling us which tapes you'd like in an ideal world. It all depends on what we can find.

And you don't have to cut up your *Dragon User* either — heaven forbid! Entries can be written out on a photostat or a plain piece of paper, as long as we can read'em. The ingenuity practiced by DU readers to avoid mutilating their precious paperwork never ceases to astound.

1. Plant this to raise the devil! (5,4)
2. Grinder run around the lines (4,6)
3. American President's burial place? (9,4)
4. He should not snatch! (7)
5. Tax for covert whirlpool (6,6)
6. I mounted trouble when the pit was closed (5,3)
7. Organise some resistance — don't sit on it (7)
8. Britain's black gold? (5,3,3)
9. Nasty Russians! (3,7)
10. If he did this slowly, he could not be one! (5,5)
11. He looks for holes in a chart venue (4,6)
12. ET met a broker on South African journey (8)
13. The red beast visits a castle with a bishop (6,5)

All this month's answers are names of Dragon software. When the crossword is complete, the column marked with an arrow will spell out a phrase.



Expert's Arcade Arena

HELLO, and welcome to this month's straight-faced column. Thanks for your letters, but I want at least twice as many entries to the software survey as I've received — it's no contest with just my entry! (Editorial note: the Expert mocks you. Owing to the double time scheme operating here, you won't even have seen January's column at the time of writing.)

With the new year comes a new format for hints and cheats in the Arena. From now on they will have boxes round them, so that they are easier to spot when you search through your *Dragon Users* looking for a particular tip. The first words in each box will tell you to which game it refers and whether it's a hint or cheat.

Got that? Good. Let's go!

Airball cheat

Load the game using Paul Burgin's program C (Arcade Arena September 1986) and co-ordinated with the line

20 POKE 32473, LIVES

where LIVES is an interger from 1 to 255

First off the top of the pile this month is this handy POKE for *Airball* which has been passed up and down the couytry and eventually reached me. The earliest origin of the POKE I know is Mr. T. Wilkinson. Thanks, Tom. Thanks also to James Bonfield who sent in the same POKE but wasn't the first. Bad luck everyone who voted for *Airball* to be hacked in the survey, but don't worry; your votes still count. The POKE's quite useful, but how about a POKE to stop the ball deflating?

Sticking to *Airball* for a minute, I've a few pleas from people stuck with two screens. For one, I provide a solution, but the other I leave to you. The screen in question is described as SE, SE, SW, SW, SW, NW, SW which are ocmpass directions from the starting screen. It's a screen with a high wall and some vicious spikes, and is stopping people's progress with the game. Please send your solutions to the usual address.

Airball hints

To get past the scrteen which is SE, SE, SW, SW, SE, SE from the start screen, you must select eight directional movements. This enables you to jumpt into the room diagonally from the room before, and land on the two pedastals, not the deadly floor tiles. You must press two keys together (as well as Bounce) to obtain this diagonal movement, and jumpt straight towards the bottom of the screen.

Everyone out there who's having trouble getting from one screen to another in time, don't forget tha keys S and F will alter the speed of the ball.

James B. also provides a few more POKEs, some of which have already been printer and some of which I'll feature sometime in the future. To show some appreciation of his work, perhaps someone can help him with a query. He would like to know what The Oracle is. No, not ITV's Teletext service, but a utility which seems to leave messages such as "The oracle is in RAM". "Enter byte" and "Program loads too low in RAM" hidden within the coding of a large number of Microdeal games. Any ideas? You know the address.

Before I go, I've got here a few advance details for a couple of new games for 1988. Firstly, *Crazy Foota 2*, which isn't available as I write, but will be by the time you read this. I haven't got copies of the new or old versions, but the letter says that it's now greatly improved, including different colours for each team, and options to allow a variety of games by changing the duration and speed of each game. The other new game I've been told about is the latest from Paul Burgin. This time he's stuck his revising claws into *Space Monopoly*. *Space Monopoly* + apparently includes a whole list of new features, including holdings advice, controlling interests lists, joystick options, options to influence the creation of the universe and many others. The most interesting is an option to play against the computer, from 0 to 4 players. I gather that Paul is now trying to work out how he can sell the game without upsetting Microdeal. (*Paul should be looking at the news page, and having a quiet word with Harry Massey*).

Once again, the end is nigh. Apologies for a short column this month, but we all want a couple of days off at Christmas. I'll say Goodbye now, see you next month.

Adventure Contact

Adventure: *Starship Destiny, Dungeon Destiny, Wild West Destiny.*
Problem: Hints wanted.
Name: Paul Iasikiewicz
Address: 40 Sidlaw Avenue,
Parr, St. Helens, Merseyside,
WA9 2BQ.

Adventure: *Galagon*
Problem: How to get extra lives
Name: Gary Hunt
Address: 74 Ferndale Road,
Leytonstone, London E11
3DN.

Adventure: *Sea Quest/ Mystery of the Jaro Star*
Problem: Where's the mirror? Where is the Ruby hidden on the ship?
Name: Craig Dillon
Address: 24 Glen Kinglass
Road, Overton, Breenock,
PA16 9NW.

Problem: Pools predictor program needed, must be able to alter teams in divisions and send division results to printer.
Name: B. Tozer
Address: 10 Demond Ave,
Beverley High Road, Hull. Tel.
0482 443488.

Communication

Communication

Write down your problem on the coupon below (make it as brief and legible as possible) together with your name and addres and send it to Communication, 12/13 Little Newport Street, London WC2H 7PP.

Problem ....

....

....

....

Name ....

Address ....

....

....

Dragon drives direct

C.J. Walton describes an experimental interface project for DC motors

IN order to link the Dragon to motors to drive them, it is necessary to use some form of interface. There have been a number of articles in *Dragon User* detailing experiments in various aspects of interfacing, and also on the production of interface units. Such units generally have mechanical relays built into them, or may be connected to suitable relays so that external device, such as lights, heaters, motors, etc. may be switched on and off.

It is usual practice in the area of robotics to use stepper motors to obtain accurate positioning of arms and grippers. Such motors rotate in a series of very short but very precise angular steps. Thus a typical motor may have 48 steps per revolution (7.5 degree step angle) and a more precise but more expensive type may have 200 steps (1.8 degrees step angle). Stepper motors are considerably more expensive than common DC motors, and require quite complex circuitry to control them. The motors found in model railways, model racing car systems, in Fischer-Technic kits and in Lego kits are all DC motors.

This article presents experiments done to enable a measure of control to be obtained over the simple DC motors that are generally to hand. Such control cannot be as precise as with stepper motors but being able to direct a buggy, for example, to behave rather like the classic Logo turtle is possible with the system.

To simplify construction a ready-built interface unit was purchased. Electronic circuits were then built to enable the interface to run motors both forwards and in reverse. Two motors each capable of independent control would then enable the buggy to be operated. The interface unit obtained was that produced by NCJ Electronics of Hull, whose address is included at the foot of this article. It is the type 0101, and at the time of purchase it cost £14.95 inclusive. It would be as well to enquire about cost before placing an order. The interface was reviewed in the December 1984 edition of *Dragon User*. It connects to the printer socket of the Dragon and has eight lines available to connect to external circuits. The interface may be programmed in Basic using the PRINT statement or via machine code using the print subroutine B54A. All the work done in this project involved Basic. The interface uses a 74LS273 8-bit latch with a transistor on each output line to enable low current devices to be drive directly. This interface does not contain relays, and it is quite compact (about 60mm x 50mm).

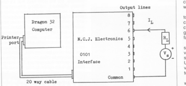


Figure one: the generalised interface connections.

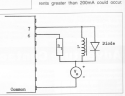


Figure two: connections for an inductive load

Using the interface

Interface 0101 is built on a small printed circuit board and connected to the computer by a 20-way ribbon cable and plug. To enable connections to be made easily to its outputs, the board was mounted in a small circuit box with a hole made at the side for the ribbon cable. The box was obtained from the local Tandy store (type 270-282 metal mini-slope enclosure, price £2.50 in a sale) and the eight line outputs and the common connection were taken to 4mm socikets which were mounted on the top of the case. Leads with 4mm plugs were then used to connect the interface to the motor circuits, which were also mounted in boxes with 4mm sockets.

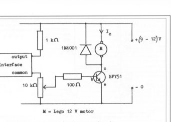
The transistor outputs are open-collector and work with inverted logic. This can cause slight problems when driving motor circuits, as will be detailed later. The general connection and use of the interface is as shown in **figure one**.

Note that the use of the Dragon's power supplies for external equipment is not advised. Batteries or a separate (preferably stabilised) power supply should be used. Under no circumstances should mains voltage be connected to any part of the interface.

Initial tests with a number of DC motors, without the interface, indicated that currents greater than 200mA could occur. Hence, although the interface might be used to drive a small motor directly, it was decided not to risk damaging it, and to construct suitable motor drive circuits. **Figure one** shows an external circuit connected between line 6 and the common connection. Any or all of the lines could be so connected, with the external power supply

Table one: variable values to set outputs ON.

Output line to be closed	1	2	3	4	5	6	7	8
value to be added to V	1	2	4	8	16	32	64	128



M = Lego 12 V motor

Figure three: operating the motor through an external transistor.

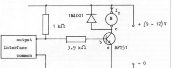


Figure four: an alternative control circuit.

negative terminals all being returned to the common connection. Generally a single power supply would be used, with the load for each line being taken to the positive side of the supply.

If the load is inductive, for instance a relay, then it is normal to include a diode across the load, as in **figure two**. When the current in an inductor is switched off, the back-emf pulse can destroy the transistor driving current through the inductor. To protect the transistor the diode is included and carries the unwanted current pulse away from the transistor.

Figure two shows a non-inductive load R1 connected to output 6, and an inductive load, such as a relay, connected to output 7. A diode is connected across L and both loads are supplied from power source Vs.

Interface programming

To program the interface in Basic, the format PRINT #-2, CHR$ (V); is used. The semi-colon is necessary to prevent a carriage return code being sent after the desired command. The variable V is the value needed to set a particular series of outputs to on (or to act as a closed switch). **Table one** indicates the required values. For example, to switch on lines 1, 3, 5 and 8, the value of V would be given by

V = 1+4+16+128=139

The program line would then be

PRINT #-2, CHR$(139);

The other lines would be left open. When a line is closed there is effectively a complete circuit from the external power supply through the load, through the line output and common connection back to the power supply. The interface acts like eight separate single pole single throw (single pole on-off) switches. Any combination of the switches may be operated by the PRINT command. As it stands, the interface may be used to control a (small) motor directly, by connecting the motor as the load L in **figure two**. Rather than risk damaging the interface by driving too much current through it, it is better simply to use the interface as a switching device and to operate the motor via an external transistor as in **figure three**.

An alternate circuit is shown in **figure four**. Here control of the motor is effected via the output line side of the interface. This becomes necessary if it is desired to operate a number of motors, with the circuit relevant to a typical medium power NPN transistor. If the interface is switched off (open) the transistor conducts (approximately Ic = 100mA) and the motor runs. When the interface is switched on (closed), the transistor base b is effectively shorted to the 0V line and the transistor is switched off (Ic = 0). The 1 kilohm resistor protects the interface from excess current when it is switched on (otherwise the power supply would be shorted across the interface).

Using a circuit similar to **figure four** a number of motors may be driven via the interface, each from one of the line outputs and with the transistor emitters all taken to the interfaced common line.

To operate the circuit of **figure three**, we need to close the interface as a switch and thus apply bias to the transistor base to cause current to flow in the collector. If we open the interface, then there is no bias to the transistor and hence the BFY51 (a typical medium power transistor) will be off. **Listing one** gives the commands to switch the motor on and off ten times. Output line 1 is used. Thus the command

PRINT #-2, CHR$(1);

closes line 1 and opens all the other lines.

PRINT #-2, CHR$(0);

or any other value for V will open all lines, including line 1.

The circuit of **figure four** has to operate in an opposite way to that of **figure three**. Here we need to open the interface switch in order to apply bias to the transistor. **Listing two** gives an example to achieve this. Again we use line output 1. By setting the value of V to 1 (line 10 of the listing) we close the interface switch; this switches the motor off initially. In line 50, V = 0. This opens the interface switch and causes the motor to run. Operation of the motor is

```
10 FOR I=1 TO 10
20 PRINT#-2,CHR$(1);: REM MOTOR ON
30 FOR T=1 TO 2000: NEXT T
40 PRINT#-2,CHR$(0);: REM MOTOR OFF
50 FOR T=1 TO 3000: NEXT T
60 NEXT I
```

Listing one: command for ten switchings.

```
10 PRINT#-2,CHR$(1);: REM MOTOR OFF
20 K$=INKEY$
30 IF K$="R" THEN 50 ELSE IF K$="O"
 THEN 60 ELSE 20: REM <R> TO RUN,<O>OFF
50 PRINT#-2,CHR$(0);: GOTO 20
60 PRINT#-2,CHR$(1);: GOTO 20
```

Listing two: command to open the interface switch.

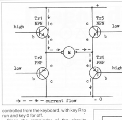


Figure five: a circuit to operate the motor in either direction.

controlled from the keyboard, with key R to run and key 0 for off.

Since the remainder of the circuits tested are of the type shown in **figure four**, it will be necessary to open the interface switch on a particular line if we wish to turn a transistor on. Sometimes we must have a number of lines open while others are closed. Care must then be taken with the final value of V used in the PRINT statement. Both circuits **figure three** and **figure four** were assembled on T-Dec boards for testing. Resistor values may then be easily changed, as may the transistors used. Any kind of prototyping or breadboard will do the job.

A major problem with circuits of the form shown in **figures three and four** is that both types can only switch a motor on or off. When running it will do so in one direction only. The most versatile control occurs when a motor can be switched to run in either direction. This can be achieved by using two of the interface outputs, two transistors and two relays. Suitable connection of the motor to the relays can then result in motion in one direction controlled by one transistor and motion in the other direction from the second transistor. A more elegant solution (and one which is cheaper and more reliable because mechanical relays are avoided) involves using a four-transistor bridge of 'H' circuit.

Figure five illustrates the principle. Two NPN and PNP transistors are used (ideally they will be matched complimentary pairs). When the inputs to Tr1 and Tr4 are set high, current flows throught them and drives the motor M in one direction. Tr2 and Tr3 are switched off by setting their inputs low, that is to the zero line.

If Tr1 and Tr4 are then set low, with Tr2 AND Tr3 set high, current flows in Tr3 and Tr2, and the motor runs in the oppostive direction. Setting all inputs low switches all the transistors off and the motor stops. Setting all the inputs high would also switch the motor off, but since some current may flow in the transistors, it is preferable to switch the motor off by setting all inputs low.

Figure six gives a typical bridge circuit. Component values are not critical, and it is worth experimenting on a Dec board before soldering up a final version.

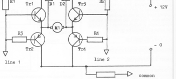


Figure six: a basic bridge circuit.

Resistors R1 to R4 should all have the same value. The 2N2905 is a PNP transistor with similar characteristics to the NPN BFY51 type. As before, diodes (1N4001 type) are used to protect the transistors when the motor is switched off or reversed. R5 is used to protect the interface should there be a fault in the circuit allowing the full supply voltage across the interface line and common terminals. It will restrict the current in the interface to a safe level (that is, more than 200mA).

Single motor drive unit

It was decided to construct the circuit of **figure six** on a small circuit board and enclosed it in a suitable box. Tandy stores supply a variety of plastic and metal boxes; a plastic box 81mm x 51mm x 35mm was chosen. This came complete with a board which had a regular array of holes drilled in it, and copper laminate connections to the holes. **Figure nine** gives the component layout on the board. Small metal pins (obtainable from electronics suppliers) were inserted into the board and short lengths of stripped wire used to link the pins to act as 'bus-bars' for the individual components. Thus the component layout is directly comparable with the circuit diagram of **figure six**. Lead connections for the diodes and transistors are given in **figure seven** and **figure eight**.

Although diodes and transistors are fairly rugged mechanically and electrically, they can be damaged by excess heat. A useful hint when soldering semiconductors is to grip the lead between component body and soldering point with a pair of long-nosed pliers. To avoid the necessity for a third hand when soldering, wrap a strong elastic band around the handles of the pliers so that they are pulled shut. When held open and placed onto the component lead they will grip it firmly without the need to be held by hand. The pliers also hold the component in place on the board if you carefully arrange things prior to soldering. Allow the heat to dissipate before removing the pliers.

4mm sockets were mounted on the box and wires connected to these from the circuit board for the two lines, common, motor and power supply. To assist in making connections to the unit the following colour coding was used for the sockets — line inputs: green; common: blue; motor: white; power supply positive: red; power

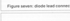


Figure seven: diode lead connections.

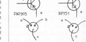


Figure eight: transistor lead connections, bottom view.

```
5 REM SINGLE MOTOR CONTROL
10 PRINT#-2, CHR$(3);: REM LINES 1 & 2 S
WITCHED ON, MOTOR OFF
20 K$=INKEY$
30 IF K$="R" THEN 50 ELSE IF K$="L" THEN
 60 ELSE IF K$="O" THEN 10
50 PRINT#-2, CHR$(1);: GOTO 20: REM LINE
 1 ON, LINE 2 OFF, MOTOR RUNS RIGHT
60 PRINT#-2, CHR$(2);: GOTO 20: REM LINE
 1 OFF, LINE 2 ON, MOTOR RUNS LEFT
70 REM LINE 1 HAS V=1,LINE 2 HAS V=2
```

Listing three: a program to run the motor left and right from the keyboard.

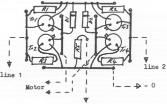


Figure nine: a component layout for the circuit board.

supply negative: black. This single motor drive unit could then be connected to the interface on the one hand and to a motor on the other. A Lego 12 volt DC motor was used to test the unit. This took 0.26A when running and driving some gears. In another arrangement, it took 90mA with less loading. When the motor was off, the circuit current dropped to 17mA. With the motor running, the voltage across one of the conducting transistors was about 1.5V so that the power dissipation in the transistor was some 350mW, well below the transistor maximum (approx. 7mW).

Listing three gives a short program to control a motor to run right and left from the keyboard. To switch the motor off we need the V value to be such that both lines are ON from the interface. This sets the two bridge inputs low. TO turn the motor on, we want one input low and one high, ie one line to be ON and the other OFF. To have line 1 ON we set V=1, which automatically puts line 2 OFF. TO have line 2 ON we set V=2, which puts line 1 OFF. Any other value for V will put both lines OFF. The program uses V=3. V values for other lines are given in **Table one**.

If the motor runs left when the R key is pressed, simply reverse the motor connections. To control motor direction by the cursor keys, replace the R and L of line 30 by CHR$(9) and CHR$(8) respectively.

Double motor drive unit

In order to run two or more motors independently we must have a separate four transistor bridge circuit for each motor. Each bridge circuit then requires two lines from the interface unit. Two motors operating independently enables a variety of two-motor devices to be controlled. Examples could be two model trains (using separate power supplies to the two sets of tracks), and X-Y plotter or a buggy.

The circuit for the double motor drive unit is simply the combination of two of the single motor units operating from one power supply. **Figure ten** gives the circuit. An extra component, D5, is used to protect the circuit (with its eight transistors) from inadvertently connecting the power supply with the wrong polarity. With no motor operating the quiescent current for a 12V supply was approximately 20mA. Operating values of current would depend on the motors being driven (see the section on use with a Lego buggy).

Construction of the circuit was again on a pinboard, this time sized about 140mm x 40mm (cut to slot into a circuit box of dimensions 150mm x 80mm x 50mm obtained from Tandy). A diagram of the component layout is given in **figure eleven**. As with the single motor unit, holes were drilled into the circuit box to take 4mm sockets. To avoid confusion during connection, I use the colour coding inputs: green; motor outputs: white; power supply positive: red;power supply negative: black; common connection to interface: blue. The transistors have maximum ratings as follows: BFY51: Vce = 30V, Ic = 1A, Pdiss = 0.8W; 2N2905: Vce = 40V, Ic = 0.6A, Pdiss = 0.6W. When operating, Vce is approximately half the supply voltage. Continuous operation could cause overheating if a motor takes more than about 0.1A. Heatsinks on the transistors may then be advisable. The present unit has not been run for more than a few minutes continuously, and the transistors barely appear warm to the touch with a 12V supply and 0.2A maximum current per motor.

The double motor drive unit was used to control a model robotic arm built from a Fischer-Technik kit (Model 30554 Computing). This uses two motors: one to rotate the arm left and right (motor 1) and one to raise the arm up and down (motor 2). The first four lines of the interface were linked to the drive unit, with lines 1 and 2 for motor 1, and lines 3 and 4 for motor 2. Motor 1 was controlled by keys R, L and O (off), with motor 2 controlled by U, D and S (stop).

To enable one motor to run whether or not the other was on at the time meant that some method of indicating the state of the motor was needed. This was achieved by having indicators or flags in the program. L1=0 means motor 1 is not running left; L1=1 means that it is running left. L2=0 means motor 2 is not running left; L2=1 means that it is running left (or down, in the case or motor 2). Thus, every keypress sets an indicator.

Listing four gives lots of REMS to indicate what is happening in the program. The V values are given in the PRINT statements and were selected so that whether motor 1 is running or not, motor 2 can be switched on or off. Likewise, motor 1 can be operated irrespective or the state of motor 2. The V values are listed in **table two** for this arrangement. Since the interface has eight output lines, a total of four separate motors, each with its own power supply, could be independently operated. If each one is to be operated independently of the others, then suitable V values would need to be selected, again with indicators to report the state of each motor. Each motor would need one bridge circuit.

One multiple-motor application could involve a model railway. Up to four trains could be programmed to run quite independently along separate tracks. A suitable program could be devised which would switch particular trains on or off at certain times. They could run forwards or backwards. The Dragon could control a set

Tr1,3	BFY51	D1,2	1N4001
Tr2,4	2N2905	R1-4	1 kohm
		R5	100 ohm

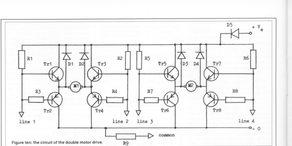


Figure ten: the circuit of the double motor drive.

timetable of train arrivals and departures from a number of stations for each train. One could even simulate British Rail by having a random element built into the program so that each train suffered a number of late arrivals and early departures, but exactly when would not be known!

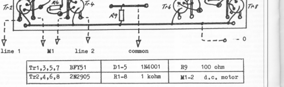
To add two more motors, with an additional motor drive circuit for each one, new V values would be have to be calculated. **Table 3** shows the basic values in pairs for right and left rotation for each motor. Combining these values as in **table two** would then be required. A comparison between the tables should enable this to be done.

The Lego buggy

The Lego buggy is assembled from a Lego kit (price about £23 ex carriage and VAT) containing two 4.5V DC motors. Each motor may be used to drive one large wheel, while a small rear wheel (undriven) provides a third contact to the ground. Running both motors together in the same direction can produce forwards and reverse motion. Keeping one motor stationary while running the other, or running the two in opposite directions, causes the Buggy to turn.

It is emphasised by Lego that the motors should not be supplied with more than 4.5V, otherwise they may burn out. Initial tests indicated that the motors tend to take a fairly constant current. Over the voltage range 2 to 4.5V, a single motor took 0.2A while the two in parallel took 0.34A. With a motor stalled (ie trying to drive against an obstacle) the current taken by a single motor rose to about 0.25A. The stall current may rise up to 1A if the motor alone, ie without gears and wheels attached, is prevented from running at maximum supply voltage. With the Buggy motors connected to the motor drive unit, a supply

Figure eleven: a component layout for the double drive circuit.



Tr1,3,5,7	BFY51	D1-5	1N4001	R9	100 ohm
Tr2,4,6,8	2N2905	R1-8	1 kohm	M1-2	d.c. motor

Listing four: the control program with flags and REMs.

```
5 PRINT#-2,CHR$(15);: REM ALL 4 OUTPUTS
CLOSED: MOTORS OFF
10 L1=0: L2=0: R1=0: R2=0: REM MOTOR IND
ICATORS SET TO 0
15 CLS: PRINT:PRINT"     TO CONTROL MOTI
ON": PRINT"     USE THE KEYS:"
16 PRINT:PRINT"      <R> MOTOR 1 RIGHT":
PRINT: PRINT"     <L> MOTOR 1 LEFT"
17 PRINT:PRINT"      <O> MOTOR 1 OFF": PR
INT: PRINT"     <U> MOTOR 2 UP": PRINT:P
RINT"    <D> MOTOR 2 DOWN": PRINT: PRIN
T"    <S> MOTOR 2 STOP"
20 K$=INKEY$
30 IF K$="R" THEN 130
40 IF K$="L" THEN 140
50 IF K$="O" THEN 150
60 IF K$="U" THEN 160
70 IF K$="D" THEN 170
80 IF K$="S" THEN 180
90 IF K$="" THEN 20
130 R1=1: IF R2=1 THEN PRINT#-2,CHR$(5);
 ELSE IF L2=1 THEN PRINT#-2,CHR$(9); ELS
E PRINT#-2,CHR$(1);: REM SWITCHES MOTOR
1 ON RIGHT
131 GOTO 20
140 L1=1: IF R2=1 THEN PRINT#-2,CHR$(6);
 ELSE IF L2=1 THEN PRINT#-2,CHR$(10); EL
SE PRINT#-2,CHR$(2);: REM SWITCHES MOTOR
 1 ON LEFT
141 GOTO 20
150 R1=0: L1=0: IF R2=1 THEN PRINT#-2,CH
R$(7); ELSE IF L2=1 THEN PRINT#-2,CHR$(1
1); ELSE PRINT#-2,CHR$(15);: REM SWITCHE
S MOTOR 1 OFF
151 GOTO 20
160 R2=1: IF R1=1 THEN PRINT#-2,CHR$(5);
 ELSE IF L1=1 THEN PRINT#-2,CHR$(6); ELS
E PRINT#-2,CHR$(4);: REM SWITCHES MOTOR
2 ON RIGHT (UP)
161 GOTO 20
170 L2=1: IF R1=1 THEN PRINT#-2,CHR$(9);
 ELSE IF L1=1 THEN PRINT#-2,CHR$(10); EL
SE PRINT#-2,CHR$(8);: REM SWITCHES MOTOR
 2 ON LEFT (DOWN)
171 GOTO 20
180 R2=0: L2=0: IF R1=1 THEN PRINT#-2,CH
R$(13); ELSE IF L1=1 THEN PRINT#-2,CHR$(
14); ELSE PRINT#-2,CHR$(15);: REM SWITCH
ES MOTOR 2 OFF
181 GOTO 20
190 REM COMMANDS FOR ONE MOTOR ALLOW OTH
ER MOTOR TO OPERATE INDEPENDENTLY
```

Listing five: the Buggy control program.

```
5 REM BUGGY CONTROL
10 PRINT#-2,CHR$(15);: REM ALL 4 OUTPUTS
 CLOSED: MOTORS OFF
20 CLS: PRINT: PRINT"       TO CONTROL B
UGGY": PRINT"       USE THE KEYS:"
25 PRINT: PRINT"         <F> FORWARD"
30 PRINT: PRINT"         <B> BACKWARD"
35 PRINT: PRINT"         <L> LEFT"
40 PRINT: PRINT"         <R> RIGHT"
45 PRINT: PRINT"         <S> STOP"
50 K$=INKEY$
60 IF K$="F" THEN 160
70 IF K$="B" THEN 170
80 IF K$="L" THEN 180
90 IF K$="R" THEN 190
100 IF K$="S" THEN 200
110 IF K$="" THEN 50
160 PRINT#-2,CHR$(15);: PRINT#-2,CHR$(5)
;: GOTO 50: REM M1 ON R, M2 ON R
170 PRINT#-2,CHR$(15);: PRINT#-2,CHR$(10
);: GOTO 50: REM M1 ON L, M2 ON L
180 PRINT#-2,CHR$(15);: PRINT#-2,CHR$(6)
;: GOTO 50: REM M1 ON L, M2 ON R
190 PRINT#-2,CHR$(15);: PRINT#-2,CHR$(9)
;: GOTO 50: REM M1 ON R, M2 ON L
200 PRINT#-2,CHR$(15);: GOTO 50: REM BOT
H OFF
```

Listing six: an alternative control program.

```
5 REM BUGGY CONTROL2
10 PRINT#-2,CHR$(15);: REM ALL 4 OUTPUTS
 CLOSED: MOTORS OFF
20 CLS: PRINT:PRINT:PRINT"       TO CONT
ROL BUGGY"
25 PRINT:PRINT"       USE CURSOR KEYS"
30 PRINT:PRINT:PRINT:PRINT"       TO STO
P"
35 PRINT:PRINT"       USE SPACE BAR"
50 K$=INKEY$
60 IF K$=CHR$(94) THEN 160:REM F
70 IF K$=CHR$(10) THEN 170:REM B
80 IF K$=CHR$(8) THEN 180:REM L
90 IF K$=CHR$(9) THEN 190:REM R
100 IF K$=" " THEN 200
110 IF K$="" THEN 50
160 PRINT#-2,CHR$(15);: PRINT#-2,CHR$(5)
;: GOTO 50: REM M1 ON R, M2 ON R
170 PRINT#-2,CHR$(15);: PRINT#-2,CHR$(10
);: GOTO 50: REM M1 ON L, M2 ON L
180 PRINT#-2,CHR$(15);: PRINT#-2,CHR$(6)
;: GOTO 50: REM M1 ON L, M2 ON R
190 PRINT#-2,CHR$(15);: PRINT#-2,CHR$(9)
;: GOTO 50: REM M1 ON R, M2 ON L
200 PRINT#-2,CHR$(15);: GOTO 50: REM BOT
H OFF
```

To run Motor 1	ON R	ON L	OFF
with Motor 2 OFF ON R(U) ON L(D)	1 5 9	2 6 10	15 7 11
To run Motor 2	ON R(U)	ON L(D)	OFF(STOP)
with Motor 1 OFF ON R ON L	4 5 6	8 9 10	15 13 14

Table two: V values for Listing four.

Motor 1		Motor 2		Motor 3		Motor 4	
R	L	R	L	R	L	R	L
1	2	4	8	16	32	64	128

Table three: values for left and right rotation.

	M1	M2	V
To move forwards F needs both motors ON R	R 1	R 4	5
To move backward B " " " ON L	L 2	L 8	10
To move left L needs M1 L and M2 R	L 2	R 4	6
To move right R needs M1 R and M2 L	R 1	L 8	9
To stop Buggy needs both motors OFF	1+2	4+8	15

Table four: values to drive the Buggy.

of 9V was needed to ensure that each motor received 4.5V, or a little less, when the Buggy was operating.

The Basic program needed to control the Buggy's movements requires suitable values of variable V. These will depend on how the motors are wired with regard to the polarity of the outputs from the motor drive unit. It will be necessary to experiment a little here. Viewing the Buggy from above and denoting the left-hand motor M1 and the right-hand motor M2, we may set up the table shown. A motor running right R is deemed to be in the forward direction, running left L is taken as backward/reverse.

Note that in order to turn to L or R both motors are running. Turns may be effected by stopping one motor and driving the other. However, if this is done the power supplied to the Buggy is halved and the single motor running has difficulty in driving the Buggy. Hence the speed falls. On the other hand, by stopping one motor, the Buggy will pivot about the point of contact of the stopped wheel. This will give a more precise description of the path of the Buggy. In this case, the third and fourth lines of the previous table need modifying to:

To move left L needs M1 OFF and M2 R	OFF 1+2	R 4	7
To move right R needs M1 R and M2 OFF	R 1	OFF 4+8	13

The Buggy control program given in **listing five** operates with both motors running for a turn. Motion direction is selected by the F, B, L and R keys, with STOP by S. When a new key is pressed the command to stop both motors is issued prior to starting the new motion. In view of the speed of the Dragon's signals this command will have little effect. However, if a time delay is inserted after the command (in lines 160 to 190), the Buggy can be made to pause for as long as required. This may be useful in some situations.

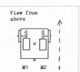
An alternate control program is given in **listing six**. The Buggy will now respond to the cursor keys for direction control and is stopped by the space bar. This may be found to be a more convenient method of control, particularly if an extended series of direction changes is needed. Again both motors operate on a turn.

Having obtained control of the Buggy, a felt-tip pen could be attached to it (eg clamped by a clothes peg) and Turtle-type graphics done on paper. For true LOGO control one needs to adapt a suitable program (perhaps Mike Horden's *Mini-LOGO* in *Dragon User*, September 1986) or write one's own.

Extra points

To stop the Buggy when it collides with an obstacle, one technique uses microswitches at the front and rear of the Buggy. These are in series with diodes and the motor, as shown in **figure twelve**. The switches should be of the normally closed type and when contact is made with the obstacle the switch opens and cuts off current to the motor via the relevant connector. Two diodes and two switches are used because current has to flow in two directions, depending on which way the motor is running.

If more powerful motors are to be used, the transistors used here will be overloaded. In this case, two transistors of the same type may be doubled up to form a Darlington pair as in **figure thirteen**.



The Buggy viewed from above.

Alternately, it is now possible to buy devices containing one Darlington pair in a single package, or multiple pairs in a single package. Recently, complementary transistor arrays have appeared. One contains two NPN and two PNP transistors in matched pairs in a 14 pin DIL plastic package (500mW dissipation per transistor). This would be ideal for producing one motor drive unit circuit for, say, the Lego motor, on a printed circuit board (but rather expensive, as yet).

Finally, please note that I have no business connection with NCJ Electronics, the producer of the 0101 Interface Unit used for the experiments described in this article. It was good luck in the first place that acquainted me with the interface and enabled me to devise the experiments for myself over a period of time.

Component sources

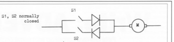
The address of **NCJ Electronics** is 38 Murrayfield Road, Chanterlands Ave, Hull HU5 4DW.

Two suppliers of electronic components to the amateur constructor are given below. Others, of whom the largest and best known is probably Maplin Electronics, may be found in the pages of any electronics magazine such as Practical Electronics, Electronics Today International, Everyday Electronics, Practical Wireless or Radio and Electronics World.

Rapid Electronics, Hill Farm Industrial Estate, Boxted, Colchester, Essex CO4 5RD.

Magenta Electronics, 135 Hunter Street, Burton-on-Trent, Staffs DE14 2ST.

The Lego Buggy can be obtained from **Economatics** Ltd., Epic House, Orgreave Road, Handsworth, Sheffield S13 9LQ, **Unilab Ltd.**, Clarendon Road, Blackburn, Lancs BB1 9SS, and **Magenta Electronics**. It is also available in some large toy stores.



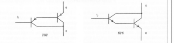


Figure twelve: bi-directional switching to stop the Buggy.

Figure thirteen: transistors doubled to form a Darlington pair.

Parts lists

Single motor drive

2 x BFY51 NPN transistor
2 x 2N2905 PNP transistor
2 x 1N4001 1A 50V diode
4 x 1 kilohm 0.25W resistor
1 x 100 ohm 0.25W resistor

1 plastic box to suit
1 x pinboard to fit box
7 x 4mm sockets
Pins and connecting wire

Approx. cost of unit: £4.00

Double motor drive

4 x BRY51 NPN transistor
4 X 2N2905 PNP transistor
5 x 1N4001 1A 50V diode
8 x 1kilohm 0.25W resistor
(8 x TO5 package heatsink)

1 plastic box to suit
1 pinboard to fit box
11 x 4mm sockets
Connecting wire

Approx. cost of unit £8.50

While Dragon User makes every reasonable effort to ensure that published projects are viable, it cannot be held responsible for any loss or damage arising from such projects. These projects do not employ mains voltages directly, and are not difficult to build, but require care and attention to detail to achieve success. If in doubt, ask the advice of someone with greater experience of electronic construction. Check that all the components you want to use are available from suppliers, and the current prices, before ordering.

CLASSIFIED ADS

APOLOGY: Owing to the vagaries of the Christmas post, we are without our classified advertisements this month. Normal service will be resumed as soon as possible. Meanwhile, an announcement from one of our customers:

Hereford (0432) 263476 is offering Dragon software for sale for the price of **£100 ONO**, and not £400 as previously stated. A Dragon 32 and hardware are also available.

HERE'S MY CLASSIFIED AD.
(please write your copy in capitals on the lines below)

Name ....

Address ....

.... **Tel:** ....

Classified rate: 35p per word.

Please cut out and send this form to: Classified Department, Dragon User, 12 – 13 Little Newport St, London WC2H 7PP.

Write: ADVENTURE

Pete Gerrard comes up with some codes for characters

SO far in this, the only mini-series in the world not to feature Joan Collins (thank heavens), we've managed to introduce fairly simple characters who do little more than be around, and gone on to consider more advanced creations who are capable of contributing significantly to the enjoyment of the game. They are also, in most cases, rather important in the solving of it was well.

This month we'll be looking at extracts from a real game, and as usual I'll have to make an apology for talking in expanded bits of Basic rather than the real listings themselves. These, sadly, would make little or no sense if used as stand alone listings, so I hope you'll make allowances for that and I'll try and point out where to make the necessary changes.

We're going to be meeting, once again, living legend, Dimli Gloing the Wonder Dwarf! Plus a few of his pals, as we're going to consider the introduction of several characters (and the corresponding verbs required) into an adventure game. They're all different, with varying attributes depending on their status in the adventure in question, some are useful, some are just decoration, but we'll sort all that out when we come to it.

By considering a real adventure you should be able to get a better idea of how characters are used and controlled, certainly better than if we just talked in general terms. So, in order of importance we'll be meeting Strombrigner the Grey, Legless the elf, a guide dog, Rolf Harris (how did he get in here?!) and Balin Hey. You, of course, take on the role of Dimli Gloing, master of them all, and as such need no introduction. Oh all right then, a brief word. Your're a dwarf, and in the game have a specific mission to complete. No treasures to collect, just a series of bizarre solutions. Alas for you it is impossible to complete the adventure without the help of several accomplices, and the first one you'll meet is Strombrigner the Grey.

Strombrigner is the hero of a couple of stories in a magazine that shall be nameless, and all you need to know is that his parents were dyslexic, hence the unusual name. Being a wizard, he is capable of casting spells and generally sorting out one or two things that you can't manage, but he does have this liking for a drop of ale or two. Too little, and he is unable to stop his hands shaking and cannot cast a spell to save his life. Too much, the obvious result occurs, and he still cannot cast a spell. So one of your tasks is to ensure that he manages to pay at least one visit to the pub, but no more than four. To add to your problems, he's a stubborn old goat, and will sometimes need a bit of persuading in order to comply with any request you might give him.

Figure one shows him making his first, and subsequent, appearances in the game. As this is an ideas forum rather than a programming course we won't go into too much detail, but you should be able to get my drift, as that strange saying has it.

Two things to note. The subroutine at line 2428 is a simple delay loop to give you time to read a message, and the subroutine at line 5990 extracts and prints a message denoted by the variable 'me'. Right then, let's have a look at Strombrigner.

Line 1082 first of all. This is used if the wizard has never wandered into the adventure before, and you are in the correct location for meeting him. CP holds the player's current position, and location 12 being the heart of the pub means that the wizard here. Then we set the 'wizard wondered' flag, 'ww', the 'wizard following' 'wf', and print up descriptions.

Lines 1084 and 1085 introduce a couple more variables, namely 'ss' and 'vp'. 'vp' is used to keep track of the number of visits that he makes to the pub, and 'ss' is used to keep an eye on how long Strombrigner has stayed with you without being given something to do. Now then, if the wizard's following you and the random number falls within a given range and 'ss' is less than 11 then a random message about Strombrigner is printed on the screen. Unlike Thorin, the wizard sits down and sings about beer, or other things. However, if the variable 'ss' is greater than 10 then old Stombrigner gets a fit of the sulks at being given nothing to do and, provided that you're not already in the pub, he wanders off back to it, saying something along the lines of "Well, I'm off to find a decent ale house". Various flags and variables are set as a result of this.

Line 1086 is only used when you go off to retrieve the wizard, and if you're in location 12, the wizard's already been found once (ww=1), he's not following you at the moment (wf=0), then set the 'wf' flag and print up a message about him reappearing by your side and being ready to join in the game again.

Just four lines of code to give the wizard a real slice of character. He does random things, he sometimes sulks and stomps off to the pub, but when you find him again the shamefaced old boy is ever ready to try and help you out, if he can. Of course, there is a lot more code involved with Strombrigner than this, because you can talk to him and ask him to do things, but as I've said this is not a programming course. Instead, we're just discussing characters and how they can easily be introduced to your games.

Strombrigner is a meaningful character, in that the adventure cannot be finished without him being there to help you, but the next one that we'll look at is just decorative. This is Legolas the elf, always to be found in the pub, and as the game progresses he

Listing one

```
1082 IF CP=12 AND WW=0 THEN WW=1:WF=1:FO
R Q=1 TO 3:ME=Q:GOSUB 5990:PRINT:GOSUB 2
428:NEXT
1084 IF WF=1 AND RND(100)>75 AND SS<11 T
HEN ME=RND(3)+8:GOSUB 5990:GOTO 1086
1085 IF WF=1 AND RND(100)>75 AND SS>10 A
ND (CP<11 OR CP>17) THEN ME=4:VP=VP+1:OB
(17)=0:WF=0:SS=0:GOSUB 5990
1086 IF CP=12 AND WW=1 AND WF=0 THEN WF=
1:ME=5:GOSUB 5990
```

Listing two

```
1080 IF (CP>11 AND CP<18) THEN LL=LL+1:P
RINT:IF LL>10 THEN LL=10:ME=99+LL:GOSUB
5990:GOTO 1082
1081 IF (CP>11 AND CP<18) THEN ME=99+LL:
GOSUB 5990
3452 IF (CP>11 AND CP<18) AND NA=31 THEN
 ME=182+LL:GOSUB 5990
```

Listing three

```
2457 IF NA=61 AND DB=1 THEN PD=0:LO=1:PR
INT"IT DECIDES TO FOLLOW YOU.":OB(61)=-1
:ZZ=ZZ+1:GOTO 10
2458 IF NA=61 THEN ME=204:GOSUB 5990:GOT
O 10
```

rapidly ends up being Legless the elf, and the messages used reflect this (**figure two**).

A character should never be used in a game unless he, she, or it, adds something to it. You may feel, therefore, that Legless is a mite redundant, but when the game was being play tested one of the 'testees' said that she kept looking around the pub in order to see what Legless was getting up to next, completely forgetting about getting on with the adventure in order to keep track of our friendly elf. So, he fulfils his purpose by adding enjoyment to the game. So much so that someone else (hello Sandra!) told me that she wanted to talk to him as well, and in a very simple way we can take care of that possibility also.

Line 1080 checks first of all to see that you're in the pub, and if so the 'legolas legless' variable is incremented by one. Since the chap can only handle so much beer we then see how many he's had, and print up a suitable message informing the player of the elf's current state of health. Once he's had enough he becomes totally incapable of doing anything at all, and line 1081 sorts out the final message in the sequence. There are ten messages used in total, and that seemed to be enough to keep people amused while playing the game.

Line 3452 is the 'talk to legless' line, which again checks to see whether you're in the pub. If you are, and you're talking to noun number 31 ('legless'!) then we use the 'legolas legless' variable 'll' again in order to extract a suitable message from our file. Again, you're not really talking to him in the sense that the responses are pre-programmed, but it serves to enhance the feeling of genuineness about the elf.

The game is capable of being solved without Legless being in there at all, but it would be a poorer game without him.

We'll draw a discreet veil over the activities of Rolf Harris and Balin Hey (I'll have to start marketing the thing so that you can meet them yourself!) and finish off by looking at the guide dog. At first he started off by being like the elf, just there for decoration, but at a suggestion from someone he grew to play a much more active part in the game. My friend said, reasonably enough, that people are fed up with looking for torches to light their path in a cave, so why not use the guide dog in that respect, to guide you through the darkness of the caves? Good idea, and so that is what this particular character now does.

Before using the guide dog you have get hold of it, of course, and that is the purpose of **figure three**. As with Strombrigner there is plenty more code concerning the dog, but this should give you some idea anyway. The noun variable 'na' is equal to 61 if the player is trying to get the dog. If the 'dog given bone' variable 'db' and the 'played pool' variable 'pp' are both equal to one then you can safely take the dog. Thus we turn off the 'pitch dark' variable 'pd', turn on the 'light on' variable 'lo' (both of which are checked when the player is deep underground in the inky blackness) and put the dog in the player's possession after printing up a suitable message. If either of the two variables 'pp' and 'db' are nto set (and if you want to know why it's necessary to play pool before getting the dog then you'll just have to play the game!) then line 2458 prints up a suitable message.

Conclusion

We've only looked at nine lines of code governing three very different characters, but that should be enough to give you an idea of what they're about, how they work, and how they affect the game. Also about how various verbs are needed: talk, for example. No character should be put in if it doesn't, in some way, make for a better game, and in their own individual ways Strombrigner, Legless, and the guide dog, all contribute to the enjoyment of the adventure as a whole.

Well, I hope I've managed to give you an insight into a) how I write adventures, and b) what, as a player reviewer, I'm looking for in other people's games. Characters are all important, don't neglect them.

Bye for now.

PICTURE the scene if you will. It is a frosty morning in Wigan two weeks before Christmas, and Our Beloved Editor is already demanding the copy that you're now reading! There's a black and white rabbit in next door's garden, there's an enormous alsatian bounding around two doors away from the rabbit, but the animals haven't met each other yet. This is not an aid to concentration, and I shall continue to report on the situation as the column progresses.

Some of you may recall my accqquaintance Professor Deadrock from an earlier *Dragon User*. July issue, for the curious amongst you. Well, it looks like he's been out and about exploring again . . .

Dear Diary

Found myself taking the unusual step of arranging a winter break courtesy of the *Trekboer* Adventure Club. What a strange place to begin, though, people leaving things lying about all over the place. Found a manual, decided to open it to read it and see if I could make any sense of my surroundings, and a key popped out. Most odd. Naturally enough I then tried unlocking a nearby cabinet. No one else around, so no-one to see my somwhat furtive actions. Have no wish to bring shame on the family name. Looked in the cabinet and took everything out of it. A strange assortment of items. Suddenly (was it something I had done?) I received a strange message, and on further exploration found a likely looking robot and read my message. Something about the co-ordinates, which I suppose I had better take a note for future use.

In a burst of inspiration I set the co-ordinates to the number that I had been given, 8350, and pressed a distinctly dangerous looking red button. Explored still further, and found myself in the teleport room. Naturally my curiosity got the better of me and I pressed the button in there, too, and wearing my best suit and carrying a beaker for any strange bits and pieces that might be waiting for me I entered the window that appeared before me. I was on a planet at last.

By going south and east I stumbled across an unusual ship lying in the middle of nowhere. By the simple expedient of going to the hatch I found myself inside it, with many objects to take and examine. I managed to get a map, a shovel, a canteen (so much for the beaker) and a cartridge from a helpful robot. Thought that was enough to be going along with, and after going north and filling my beaker with acid (might as well use if for something) I teleported myself back to the warmth and security of my own ship. What a peculiar day's exploration.

Had the most fitful of night's sleep, but awoke feeling vaguely refreshed for all that and ready to tackle the next stage of my adventure, whatever that might entail. The cartridge looked as if it were designed to be inserted into the device in front of me, and sure enough so it was. I pressed the button, and looked in the drawer until it was empty.

A ladder, eh? I went up it, but by the merest chance I stumbled at the top and managed to spill the acid all over a panel. It dissolved, of course, and I looked around cautiously to see if anyone would notice this accident and come and reprimand me, but these must be dashed exclusive holidays for nobody else appears to be around at all. Was beginning to feel lonely at the thought of it, but I realised that I must continue and as pressing buttons had not done me any harm so far I pressed the white one that lay before me. So many buttons, so little dangerous effects to date.

Thought I'd better go back and replace the acid that I had been carrying, you never know with stuff like this, if one person uses it then they'll all want it sooner or later, so made a quick trip back to the desert planet and filled up again. Didn't like to drop the beaker anywhere, it looked extremely fragile, but I suppose a cushion or a pillow would break its fall if needs must. I decided to persevere.

Read my map, which told me that the co-ordinates for the intriguingly named ice planet were 3816. Entered them into my favourite device and pressed the friendly red button as before. Wearing my trusty suit, which I was now beginning to feel almost at home in, although it is in truth a far cry from the smoking jacket that I normally favour, and carrying a shovel and a blanket I made my way to the teleport room and blundered down onto the surface of the planet.

Holiday on the sun?

One cannot help wondering, dear diary, where all these unusual planets come from, and how these holiday agencies find them and manage to retain them exclusively for us holidaymakers. A desert planet, an ice planet, whatever next, one wonders? A garden planet perhaps? We shall see as I find more co-ordinates no doubt. Meanwhile, I must carry on with my exploratiuons of this ice planet and see what we can find. Ice, I shouldn't wonder.

After much digging I managed to obtain what appeared to be a sufficient quantity of ice for whatever possible needs I might have for it, and the blanket seemed to be the easiest of things to carry it all in without it slipping away or melting into an embarrassing puddle that would be awkward to explain away at best. On roaming around I found an interesting cenotaph, and although not the athlete that I once was I stumbled and fumbled my way to the top of it. Lo and behold I found an amulet, and couldn't help but think what a splendid souvenir that would make for Mrs. Armstrong at the Bridge Club. But I digress.

From the cenotaph I deduced yet another set of co-ordinates. What a lot of numbers to remember for sure, and I am fortunate that despite my advancing years I still have a retentive memory. But, time was getting on, and although it might have been merely my dour surroundings I was in dire need of some sleep to awake invigorated for the challenges of what will hopefully be my last journey to another planet. In some haste I made it back to the comfort of my own ship and once mroer settle down for the night.

Had the strangest dream, all about spiders, but cannot make head or tail of it for there are no such beasts on the ship. I have examined it thoroughly.

Garden centre

As carrying all this was beginning to get awkward I decided to wear the amulet, and felt at once strangely reassured by its presence. Having set the co-ordinates in my usual way and pressed the red button I decided that the blanket was a burden that I could well do without, and I dropped it and its ice into a convenient barrel. So much for that! Carrying my beaker carefully this time, I also took along with me a capsule and a rope, wearing as ever my trusty suit and with the amulet firmly in place. I teleported myself onto the surface of this brave new world, and what did I find, dear diary? A garden planet, just as predicted.

On arrival I went east from the bridge and tied the rope to the tree. I could now cross in safety and almost immediately found myself blundering into a forcefield. Something seemed to be protecting me, however, and I glanced reassuringly at the amulet, convinced that it had done the trick. Might as well keep it for myself rather than giving it to Mrs. Armstrong. She can have the space suit when I've done with it.

Good lord, a spider! My dreams are all coming true, and in desperation I tried feeding the beast with the capsule. To my relief it appeared to welcome such a feast, although heaven only knows I'm going to send a stiff reprimand to the holiday company on my return for the dreadful food that I personally have had to suffer. Fortunately it would appear that I have not suffered as much as the spider, who ate the capsule and promptly became unconscious. I will admit to feeling a pang of sorrow, one doesn't like to see even the lowliest of creatures in pain, so in my fit of remorse I lurched over to a strange room and left it there. This was after carefully removing what I discerned to be a Xendos plant, which will surely win many a prize at the next horticultural show in the village. That will put a few noses out of joint, I can assure you.

Outside this strange room I pressed a button, and I think that I've somehow managed to kill the spider. This is indeed unfortunate, but one cannot stop to ponder the fate of every animal and insect in the world, and I must hurry on. I stumbled across a grate, but unlike every other grate I've ever met on an adventure holiday this one didn't take too kindly to being opened with a key, or so I deduced. In a fit of pique I jumped up and down, and by the merest of accidents managed to spill some acid on it. I leapt aside hastily and watched in amazement as the grate dissolved just like the panel earlier. However thirsty I get I made a vow never to even think of drinking the acid. Or watering the plant with it, hardy annual or no hardy annual.

Rope trick

On going through the remains of the grate I found myself to my horror in front of a plain of lava. Fortunately there were some pieces of rubble scattered about and I could walk over with ease. Then I had to give myself a pat on the back for my foresight. The rope had nothing to do with the bridge, but was now available for me to climb and make my journey back to my ship easier and safer. What a pleasant surprise, and one up for Deadrock, eh diary?

Once back in my ship I planted the Xendos flower before setting the co-ordinates to 1042 and the journey home to earth. Taking the Xendos flower and going over to and through the teleport window saw the end of my adventure and winter weekend break. Perhaps I'll give the flower to Mrs. Armstrong after all. She probably likes flowers.

And this is me again! What unusual adventures the old chap has, eh? Well, no time for dawdling, must get this in the post to Our Beloved Editor. Time only to tell you that the rabbit has now settled down under a large bush, presumably eating its way out from the inside, and the alsatian has vanished into the distance somewhere. Rabbit lives again to fight another day. Bye for now.

Adventure Contact

To help puzzled adventurers further, we are instituting an Adventure Helpline — simply fill in the coupon below, stating the name of the adventure, your problem and your name and address, and send it to Dragon User Adventure Helpline, 12/13 Little Newport Street, London WC2H 7PP. As soon as enough entries have arrived, we will start printing them in the magazine.

Don't worry — you'll still have Adventure Trial to write to as well!

Adventure ....

Problem ....

....

Name ....

Address ....

....

....

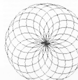
Down in the dumps

This month's screen dump is for a Brother HR-5 printer

THIS program will copy the contents of the screen to a Brother HR-5 printer. It can be incorporated into your own programs as a subroutine in the manner shown, or used as a stand-alone utility to dump screens from other programs.

To use the program in the second way, DELete lines 10 to 50, change line 190 to END, DELete lines 200 onwards, RENUMber and save the new version to tape. Load and run a program until you see a screen you wish to copy and press BREAK. Load the screen dump and RUN. The screen will now be printed out

Being in Basic, the execution time is rather slow, so have a cup of coffee while you're waiting.

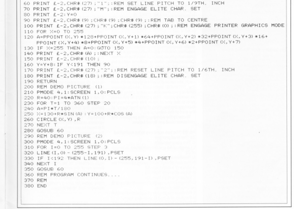


Note on lines 130 to 150
In theory, these should read as follows:

130 PRINT £-2,CHR$(A);
140 NEXT X
150 PRINT £-2,CHR$(10);

However, if you substitute these lines for the equivalent ones in the program listing, you will find that when dumping a pattern or picture that fills the entire screen, as in the second example given, unwanted characters may be printed at the end of some lines. I don't know the reason for this, and the only way I've found to avoid it happening is by sacrificing the final column of pixels. Advice please, anyone?

K. Redhead



```
10 REM PROGRAM: SCREEN DUMP SUBROUTINE
20 REM SYSTEM: DRAGON TO BROTHER HR-5 PRINTER
30 REM AUTHOR: K.REDHEAD. 1987.
40 REM
50 GOTO 210
60 PRINT £-2,CHR$(27);"1";:REM SET LINE PITCH TO 1/9TH. INCH
70 PRINT £-2,CHR$(27);"M";:REM ENGAGE ELITE CHAR. SET
80 PRINT £-2:Y=0
90 PRINT £-2,CHR$(9);CHR$(9);CHR$(9);:REM TAB TO CENTRE
100 PRINT £-2,CHR$(27);"K";CHR$(255);CHR$(0);:REM ENGAGE PRINTER GRAPHICS MODE
110 FOR X=0 TO 255
120 A=PPOINT(X,Y)*128+PPOINT(X,Y+1)*64+PPOINT(X,Y+2)*32+PPOINT(X,Y+3)*16+
    PPOINT(X,Y+4)*8+PPOINT(X,Y+5)*4+PPOINT(X,Y+6)*2+PPOINT(X,Y+7)
130 IF X=255 THEN A=0:GOTO 150
140 PRINT £-2,CHR$(A);:NEXT X
150 PRINT £-2,CHR$(10);
160 Y=Y+8:IF Y<191 THEN 90
170 PRINT £-2,CHR$(27);"2";:REM RESET LINE PITCH TO 1/6TH. INCH
180 PRINT £-2,CHR$(18);:REM DISENGAGE ELITE CHAR. SET
190 RETURN
200 REM DEMO PICTURE (1)
210 PMODE 4,1:SCREEN 1,0:PCLS
220 R=40:PI=4*ATN(1)
230 FOR T=1 TO 360 STEP 20
240 A=PI*T/180
250 X=130+R*SIN(A):Y=100+R*COS(A)
260 CIRCLE(X,Y),R
270 NEXT T
280 GOSUB 60
290 REM DEMO PICTURE (2)
300 PMODE 4,1:SCREEN 1,0:PCLS
310 FOR I=0 TO 255 STEP 3
320 LINE(I,0)-(255-I,191),PSET
330 IF I<192 THEN LINE(0.I)-(255,191-I),PSET
340 NEXT I
350 GOSUB 60
360 REM PROGRAM CONTINUES....
370 REM
380 END
```

Faster, faster, faster!

Gordon Lee wants a quicker run-time. You tell him.

Prize

DRAWING conclusions from a Gordon Lee puzzle is a well known way of giving a programmer a pain, but drawing anything else can be nearly painless with a copy of David Makin's hot-off-the-duplicator graphics program *Picture Maker*. John Penn Software, David'd publisher, are offering 10 *Picture Makers* and ten discount vouchers for this month's winners.

Rules

When you have reduced the Lee Listing to Lightning duration, print out your program, add any notes (bribes will be consumed if not considered), don't forget the tiebreaker, put it all in an envelope marked FEBRUARY COMPETITION and send it to the usual address (on the front cover, if any of you are still searching.).

This month's tie-breaker is something close to the hearts of many of us: send in any suggestion or suggestions for improving the running times of all or any British Rail train. Quality rather than quantity is the key. Extra points for anything we can't think of an easy British Rail-type excuse far.

November winners

THERE's nothing like a bit of literature to empty a dance floor, is there? All we ask you to do is make up a few six letter words, think of a definition, and get them accepted at the *Oxford English Dictionary* by last Thursday, and what happens? Everybody chickens out, except a small and select band whose winning representatives are remembered here in their glory. They are: Mark Towlson of Long Eaton, Phil Sapiro of Woolton, Terry Fawcett of Hendon, Paul Weedon of Wotton-under-edge, Andrew Marshall of Bletchley, Graham Barber of Sutton Coldfield, Keith David of Crawley (Three Bridges, actually, which sounds a lot nicer) and S A Siddiqui of Chiswick. Invisible medals right away and copies of *Space Trek/Reversi* donated by **R & AJ Preston** eventually.

"All the winners came up with at least one answer" says Gordon. "Top of the list with 28 words (all in *Chambers*') is Mark Towlson, for wheedling out such gems as nilgai, mucate and redeye though 'bogeye' would probably be a more appropriate term after such a splendid attempt! He also included a list of tiebreakers, adding up to 263, including PUBDOG, a pooch on the hooch, ETCHEW, and upper-class sneeze, and LINECA, an automatic goal-scoring machine."

Solution

This month's solution should be opposite.

LAST month on this page we were considering an improved method of performing a long multiplication. Such a method is given in **listing 1**, but before examining it in detail there are one or two points to be mentioned. In this program there are only three main string variables: A$ and B$ — the two strings holding the numbers to be multiplied — and Z$, the final product. The basis of this method depends on 'adding' into string Z$ each digit as it is computed, thus eliminating the need to have an array of sub-products.

In order to do this the first requirement is to define Z$ at the outset as a string of zeros long enough to contain the final product.

Listing 1

```
 10 TIMER=0
 20 A$="7129076834"
 30 B$="2763128729"
 40 C=0:L=LEN(A$+B$):Z$=STRING$(L,"0"):A$="0"+A$
 50 FOR M=LEN(B$)TO 1 STEP-1:D=LEN(B$)-M
 60 B=VAL(MID$(B$,M,1))
 70 FOR N=LEN(A$)TO 1 STEP-1:E=LEN(A$)-N
 80 A=VAL(MID$(A$,N,1)):P=D+E
 90 V=A*B+C:C=0
100 IF V>9 THEN C=INT(V/10):V=V-C*10
110 Z=VAL(MID$(Z$,L-P,1))+V
120 IF Z>9 THEN Z=Z-10:C=C+1
130 Y$=STR$(Z):Y$=MID$(Z$,2)
140 Z$=LEFT$(Z$,L-(P+1))+Y$+MID$(Z$,(L+1)-P)
150 NEXT N
160 NEXT M
170 IF LEFT$(Z$,1)="0"THEN Z$=MID$(Z$,2)
180 PRINT Z$
190 PRINT"Time taken:";TIMER/50;"seconds"
```

Now any two numbers having *n* and *m* digits respectively will, when multiplied together, result in a product having either *n* plus *m* digits, or one less than this number. Consequently, having defined variables A$ and B$ in lines 20 and 30, the total length of Z$ can be defined in line 40. In the listing, as both numbers have ten digits each, the value of L will be given as 20, and the STRING$ command which follows (line 40) will produce an initial string for Z$ as twenty zeros. The addition of the extra zero to the end of A$ in this line simply to facilitate the handling of any final 'carry' at the end of the calculation.

To clarify the working of the program, the variables used are listed below:

A$, B$ The two numbers to be multiplied
Z$ The final product
C The carry variable
L Length of A$ and B$ combined, ie length of Z$
M Position of digit in B$ being operated on
N Position of digit in A$ being operated on
A Value of a digit from A$
B Value of a digit from B$
Z Value of a digit from Z$
D Relative magnitude of current value of B (ie 0=units, 1=tens)
E Relative magnitude of current value of A
V Product of A and B, plus any 'carry'
P Relative magnitude of current value of Z

In addition to these, the TIMER is set to zero at the very start of the program to give an indication of the time (in seconds) that any computation needs to be completed.

The method used by the program listing is fairly straightforward if followed against this outline of the method used in each of the lines:

Lines 20 to 40 — Define initial variables
Lines 50 to 60 — Take each digit in turn (starting from the right) from B$ and convert to variable B
Lines 70 to 80 — Take each digit in turn (starting from the right) from A$ and convert to variable A: calculate position of current value of Z in Z$
Lines 90 and 100 — Find product of A times B (plus any carry) : Reset carry and check if V is greater than 9
Lines 110 and 120 — Extract relevant digit from Z$ (Z), and add value V: check to see if new value Z is greater than 9
Lines 130 and 140 — Convert digit Z to string Y$ and insert this character back in its correct place in string Z$

If the string Z$ contains a leading zero at the left hand end, this is removed at line 170 before the result is printed out, together with the time taken to complete the computation. On the Dragon the TIMER variable counts fifty times per second so if it is reset to zero at the start of the program the expression TIMER/50 will give the total running time in seconds.

We are now in a position to use this program to try out a much larger computation. In **listing 2** values at lines 20 and 30 (from **listing 1**) have been redefined to two 50 digit numbers to be multiplied together. Because of the extra string space needed it will also be necessary to include a CLEAR 500 command in order to reserve more bytes for string storage. this can be added to line 10 as follows:

```
10 TIMER=0:CLEAR 500
```

Listing 2

```
10 TIMER=0
20 A$="737953043442527266333901473589748181147552118453 51"
30 B$="306585487758495418836723593022217758603244993655 39"
   [2262456937666933812275324877357726759728645076794832 9
    20273071442749519791057202895364969936886759189]
```

If the program is now run with these new values the running time is much longer than before, a time in the region of 278 seconds should be typical. The actual answer is that given in square brackets below **listing 2**, so you can check your answer. This month's competition is to devise a program to perform the multiplication from **listing 2**, but in such a way as to improve on the program's running time as given above.

This can be either a modification or a listing of your own devising. It should be written in Basic, and the timer set to zero as the first instruction. Similarly, the time in seconds should be the last instruction executed by the program. Note that the use of any 'speed poke' is NOT allowed.

On a pratical level, the longer the sequence of digits to be operated on, the faster we would wish the computation to be. At the start of this article last month I said that it is possible to perform computations with thousands of digits. Of course, since there is a maximum size allowed of 255 characters in any one string variable, it would be necessary to modify any listing to break longer numbers into convenient 'blocks' of, say, 250 characters.

This technique offers many interesting opportunities to perform otherwise lengthy computations by computer.

The Answer

This is Gordon Lee's own solution to the January competition see page 26 for results

ANSWER: This words on the following list all 'sum' to 263 when operated on in the manner described:

Aching, cheesy, dragon, homage, itches, mickle, mobile, rename, sacred, sailed, scalps, seared, socked, spices, steams, Sweden

SOLUTION: As there are over 308 *million* permutations of six different letters, it is perhaps suprising that only a handful of these total the value 263. It is unlikely that, even allowing more obscure words than those on the list above, the total number will exceed two dozen. Needless to say, it is extremely impractical to examine all of these 308 million possibilities to find the acceptable words. The program, as listed, uses a number of short cuts.

Firsly, the words are built on the list of two-letter 'starters' as held in the data lines. These are all of the two-letter combinations with which a word can begin. For example, if a word begins with the letter M, the second letter can only be an A, E, I, O, U, or Y. Byusing this technique, a lot of dead ground can be eliminated.

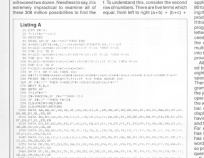
The actual 'value' that is produced by any word can be calculated in a single operation. If the values of the six letters in the word are represented by the algebraic terms a, b, c, d, e, and f, the final total will equal the expression a + 5b + 10c + 5e + f. To understand this, consider the second row of numbers. There are five terms which equal, from left to right (a+b) + (b+c) + (c+d) + (d+e) + (e+f). If this process is continued for the other four lines, the final expression can be obtained.

Once the first two letters have been read from the data statements, the remaining four letters are generated in sequence using the three loops C, D and E and the variable F (line 120). The total letter values cannot exceed 263 so, once the first two letters have been determined their final contribution to the total (a+5b) is subtracted from 263 (line 60). This will indicate the upper limit for the third letter in the word (c), and the appropriate loop can be set at line 70. Again, once the first three letters have been selected, a similar procedure can be applied for the fourth and fifth letters (lines 80 to 110). The final letter, f, is found by taking the residue of 263 minus the total value produced by the other five letters (line 120). If this is not in the range 1 to 26 (ie A to Z) the program jumps io line 160. In this way only letters which do not cause the total to exceed 263 are considered. Remember that the central two letter values have to be multiplied by 10 so the further that they are into the alphabet, the less likely they are to prove valid.

All possible letter combinations produced by the above arrangement are printed eight at a time on the screen. Pressing the space bar will display the following eight. There is one further refinement to the program which allows certain permutations to the jumped without being displayed. This operation has an effect on the *third* letter of the word. If, instead of pressing the space bar, one of the letter keys is pressed, the display will jump immediately to words having the letter indicated at third position, and the sequence will continue from there. For example, suppose that the program has listed words beginning with CR and has reached CRB... Clearly there are no words beginning with CRB, CRC or CRD, so pressing E takes the permutation to sequences beginning CRE...

By using this technique, all permissible letter combinations can be scrutinised and acceptable words extracted from them.

Listing A



```
  10 DIM S$(9)
  20 T=1:F$="":CLS
  30 RESTORE
  40 READ A$:IF A$="XXX"THEN END
  50 A=ASC(LEFT$(A$,1))-64:B=ASC(RIGHT$(A$,1))-64
  60 R=263-(A+5*B):R=INT(R/10):IF R>26 THEN R=26
  70 FOR C=1 TO R
  80 R=263-(A+5*B+10*C):R=INT(R/10):IF R>26 THEN R=26
  90 FOR D=1 TO R
 100 R=263-(A+5*B+10*C+10*D):R=INT(R/5):IF R>26 THEN R=26
 110 FOR E=1 TO R
 120 F=263-(A+5*B+10*C+10*D+5*E)
 130 IF F<1 OR F>26 THEN 160
 140 S$(T)=CHR$(A+64)+CHR$(B+64)+CHR$(C+64)+CHR$(D+64)+CHR$(E+64)+CHR$(F+64)
 150 PRINT S$(T):PRINT:T=T+1:IF T=9 THEN GOSUB 200
 160 IF F$<>"" THEN C=ASC(F$)-65:E=26:D=26:F$=""
 170 NEXT E,D,C
 180 GOTO 40
 200 T=1:F$=""
 210 Z$=INKEY$:IF Z$=""THEN 210
 220 IF Z$<>" "THEN F$=Z$
 230 CLS:PRINT:RETURN
 260 CLS:PRINT:RETURN
 1000 DATA AA,AB,AC,AD,AE,AF,AG,AH,AI,AL,AM,AN,AP,AQ,AR,AS,AT,AU,AV,AW,AX,AY,AZ.
BA,BE,BI,BL,BO,BR
 1010 DATA BU,BY,CA,CE,CH,CI,CL,CO,CR,CU,CY,DA,DE,DI,DO,DR,DU,DW,DY,EA,EB,EC,ED.
EF,EG,EI,EL,EM,EN
 1020 DATA EO,EP,EQ,ER,ES,ET,EU,EV,EW,EX,EY,FA,FE,FI,FL,FO,FR,FU,GA,GE,GH,GI,GL.
GO,GR,GU,GY,HA,HE
 1030 DATA HI,HO,HU,HY,IA,IB,IC,ID,IG,IL,IM,IN,IO,IR,IS,IT,IV,JA,JE,JI,JO,JU,KA.
KE,KI,KL,KN,KO,KU
 1040 DATA KY,LA,LE,LI,LO,LU,LY,MA,ME,MI,MO,MU,MY,NA,NE,NI,NO,NU,OA,OB,OC,OD,OF,
OI,OL,OM,ON,OO,OP
 1050 DATA OR,OS,OT,OU,OV,OW,OX,OY,PA,PE,PH,PI,PL,PN,PO,PR,PS,PT,PU,PY,QU,RA,RE,
RH,RI,RO,RU,RY,SA
 1060 DATA SC,SE,SH,SI,SK,SL,SN,SO,SP,SQ,ST,SU,SW,SY,TA,TE,TH,TI,TO,TR,TU,TW,TY,
UD,UL,UM,UN,UP,UR
 1070 DATA US,UT,VA,VE,VI,VO,VU,WA.WE,WH,WI,WO,WR,WU,XA,XE,XI,XY,YA,YE,YI,YO,YU,
ZA,ZE,ZI,ZO,ZU,ZY
 1080 DATA XXX
```